17 FEBRUARY 1955 ONE SHILLING

ELECTRICAL TIMES

MANCHESTER-SHEFFIELD-WATH RAILWAY ELECTRIFICATION SCHEME

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HIGH BAY LIGHTING — BY BENJAMIN

...at one of the world's largest Ships' Engine shops

A typical example of Benjamin High Bay lighting is this installation at the huge Cammell Laird works, Birkenhead. 1500 watt lamps—*mounted 74 ft. above floor level*—are fitted with heavy duty 'Saaflux' tops and clear glass 'Visor' Covers, rendering each unit entirely dust-proof.

For the lighting of lofty interiors . . . for the considered planning of *any* lighting scheme . . . consult the Benjamin Illuminating Engineering Service.

Better Lighting—by BENJAMIN REGD.

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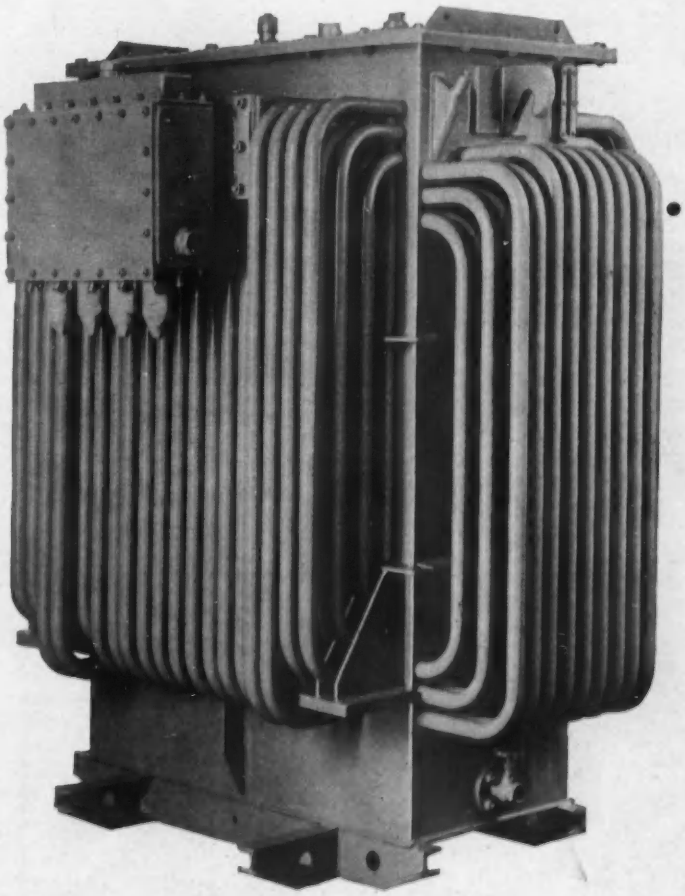
Smee's 13.54

Standard Sub-station transformers



'ENGLISH ELECTRIC' manufacture a range of ground mounting sub-station transformers and pole or platform mounting transformers to meet the British Electricity Specification T.1 (1954). An alternative range of low loss transformers is also available.

Send your enquiries to:

Transformer Sales & Contracts Department,
The ENGLISH ELECTRIC Company Limited,
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'ENGLISH ELECTRIC'
transformers

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

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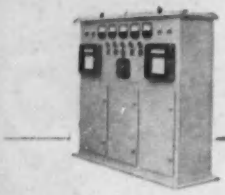
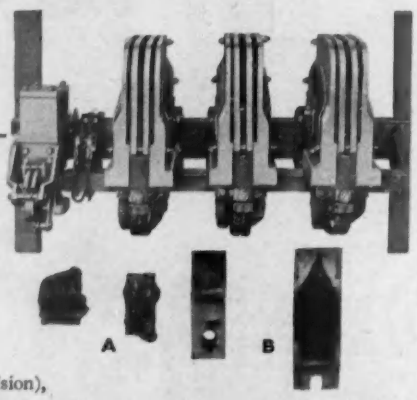
TFL.1585

A

'These G.W.B. contactors have lasted well—much better than the previous copper ones"

An important industrial organization using hundreds of machine tools had control gear trouble on a machine working on heavy plug reversing duty. When this machine is set up it plug reverses 60/85 times for the first thirty minutes and then settles down to steady running. The machine in question is used for short runs so that the punishing setting up procedure might take place two or three times per day. Conventional type control gear with copper contacts required to have the contact faces cleaned with emery cloth every day, filed every three days and replaced after three weeks. **The G.W.B. contactor unit which replaced it showed only slight wear after ten weeks operation and was not touched during this period.**





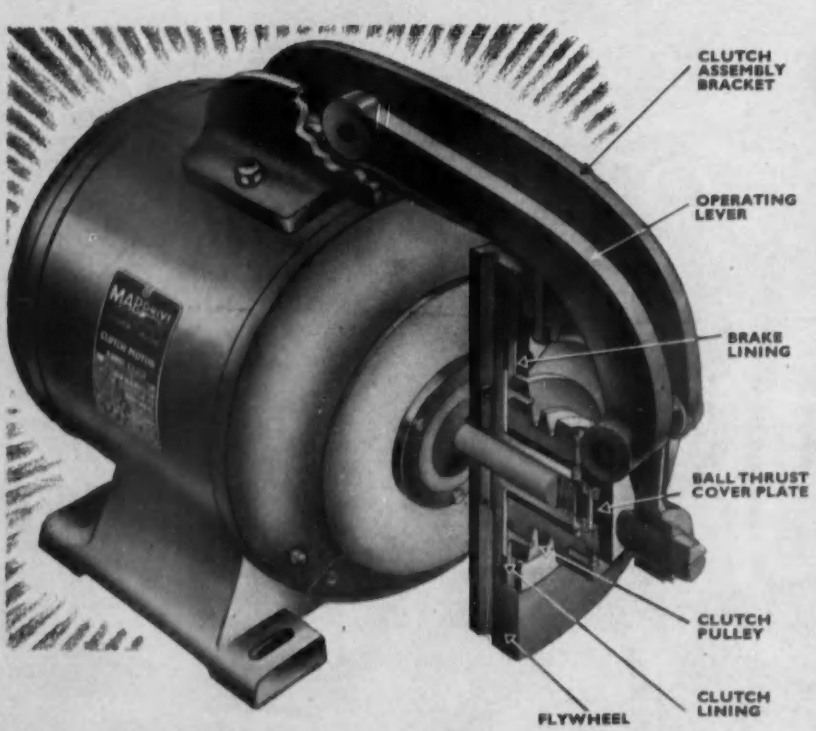
G.W.B. CONTROL PANELS

G.W.B. incorporate these special contactors in Control Panels of all types from simple units to complicated "tailor made" installations. In addition, G.W.B. offer complete design facilities and specialised advice for work of this description.

A are typical copper contacts after three weeks use. B are the long life G.W.B. contacts with the sintered tungsten-silver contact faces after seven weeks use under precisely the same conditions.

GWB

G.W.B. FURNACES LTD. (Control Gear Division),
DIBDALE WORKS, DUDLEY, WORCS. Telephone: Dudley 4284 Telegrams: Gibwildbar, Dudley
Proprietors: GIBBONS BROS. LTD., and WILD-BARFIELD ELECTRIC FURNACES LTD.



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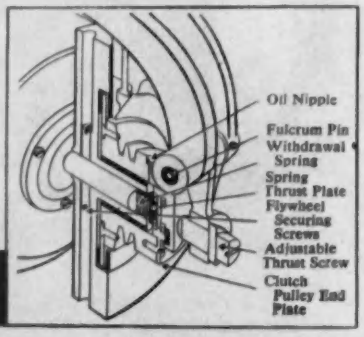
3/4 — 1½ H.P.

DI Clutch Motor

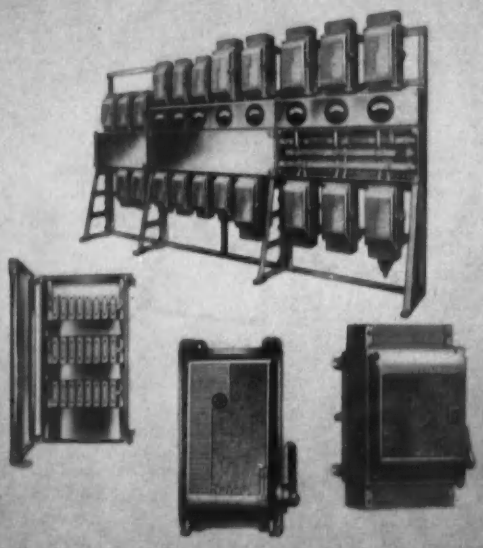
The perfect method of providing any intermittent drive for rapid starting and stopping with 'silk-like' precision.



Full details from :

The MARINE ENGINEERING CO. (STOCKPORT) Ltd
Offices: BULKELEY ST, EDGELEY, STOCKPORT Phone STOckport 2008 & 9 (2 lines)

You cannot buy better gear



THE COMPLETE INSTALLATION

by

STAND Nº 143
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EARLS COURT 15TH - 19TH MARCH 1955

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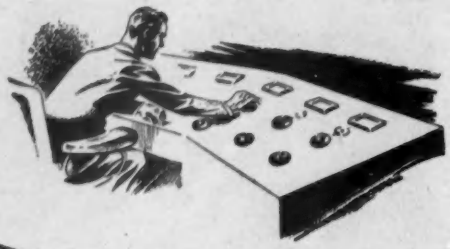
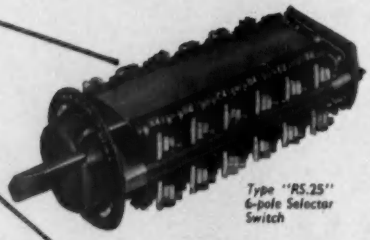
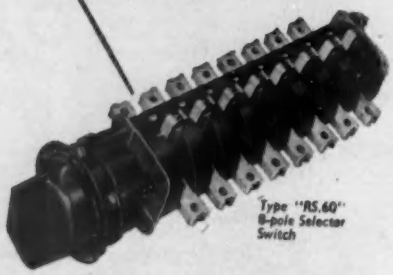
REMOTE CONTROL *through* WELL DESIGNED, WELL MADE CONTROL SWITCHES





Type "RS.25" 6-pole Selector Switch

Type "RS.25" 3-pole 'ON/OFF' Switch



Type "RS.60" 8-pole Selector Switch

The application of the control switch is rapidly increasing and a great variety of industrial equipment now calls for the inclusion of one or more types as essential features of its construction.

"Ferguson Pailin" have developed, for these purposes, the switches illustrated. They are compact, robust and positive in action, within ratings of 20/60 A—230 V.

Designed for back of panel mounting, their small space requirements make them particularly suitable where this factor is of importance—and that is ALMOST ALWAYS.

The ratings of the individual switches are as follows:—

RS.20—20 amp 230 volt, 10 amp 440 volt, A.C. up to 6 poles.
RS.25—25 amp 230 volt, 10 amp 440 volt, A.C. and D.C. up to 10 poles.
RS.60—60 amp 230 volt, 30 amp 440 volt, A.C. up to 4 poles and D.C. up to 10 poles.
RC—A "spring return to neutral" 2 or 3 position switch for use as a controller for Circuit-Breakers, Governor Motors, etc.

Type "RC" Control Switch with Pistol Grip Handle.

Specify one or more of types

RS 20/25/60

or type RC

for that control job!

Catalogue SP gives detailed information Please write for a copy

Ferguson Pailin LIMITED *for Switchgear*

Member of the A.E.I. Group of Companies

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REPRESENTED IN PRINCIPAL OVERSEAS TERRITORIES

Portrait of a member of a famous test team

Why be caught out by faulty insulation or stumped by that insulation problem. By using a "Megger" Insulation Tester you can ensure that your equipment will have a good innings.

The Series 1 instrument, illustrated above, is ideal for testing high tension equipment, insulators, transformers, motors, generators, cables, etc. Instruments are available with hand-driven generators or can be supplied with hand-and-motor drive. Ranges up to 100,000 megohms—Testing pressures up to 5,000 volts. Special 5,000 volt and 10,000 volt mains operated instruments are also available.

Please write for illustrated leaflet J 051/1

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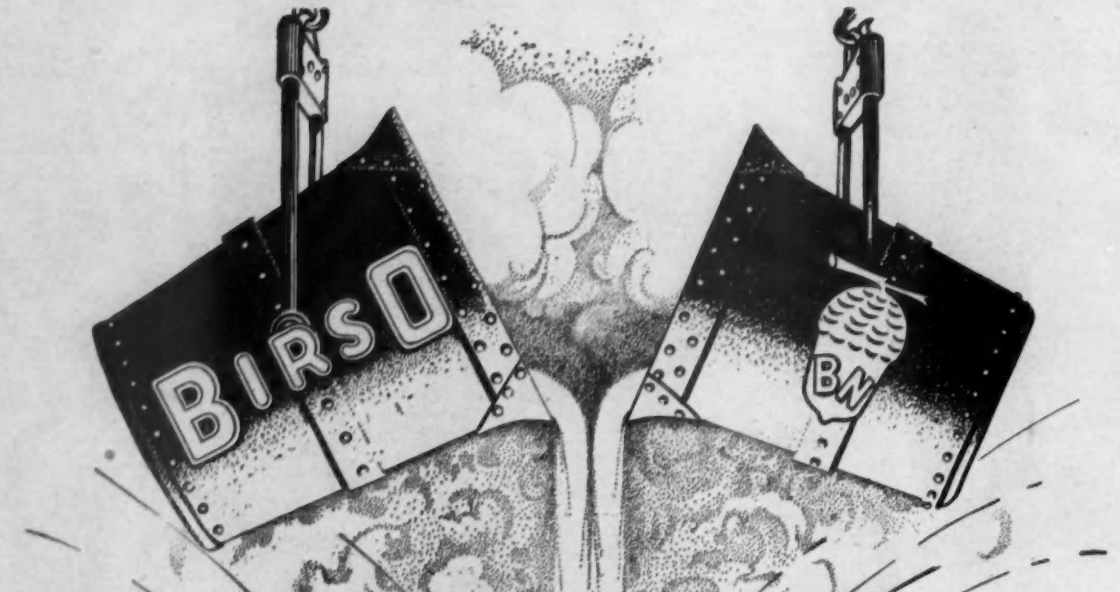

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cast in an old tradition of PERSONAL SERVICE

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LIMITED

The two famous firms of T. M. Birkett and Sons Ltd., and Billington and Newton Ltd., have pooled their unrivalled non-ferrous casting facilities and experience, to give the customers of each an *even better personal service.* The combined firms will operate from a new headquarters at Hanley, but foundries and machine shops will remain at Longport and Hanley.

Castings from a few ounces to 10 tons in phosphor-bronze, gun-metal, aluminium-bronze, manganese-bronze and light alloys. Precision-machined bushes and bearings. Specialists in high-tensile aluminium-bronze castings, centrifugal-cast wheel blanks, and chill-cast rods and tubes.

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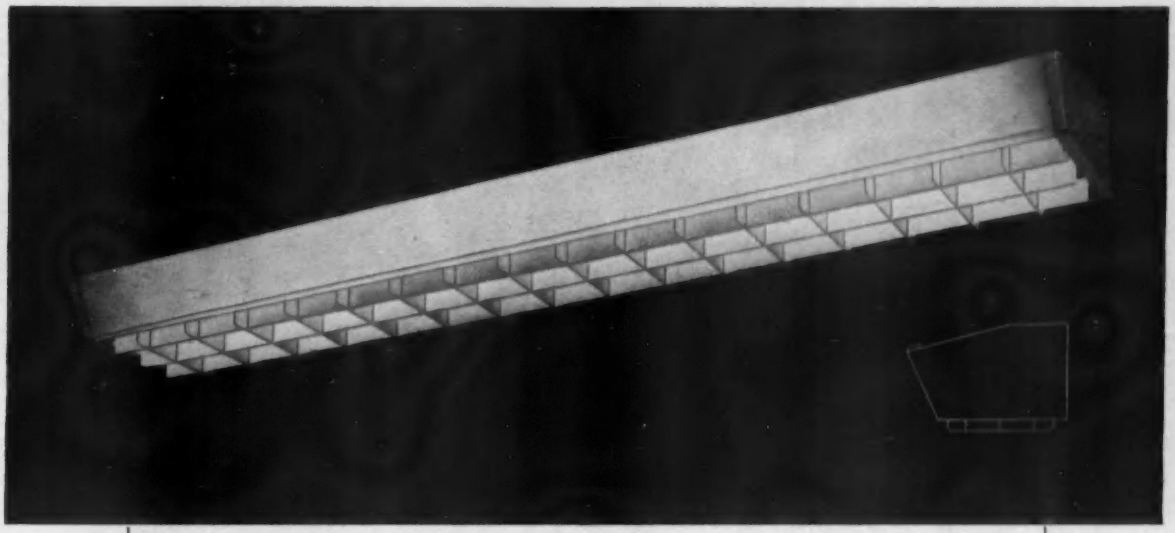
Good lighting - Good looking



How much would it cost to re-arrange your lighting?

The fluorescent lighting system chosen by Messrs. Ferranti Ltd. for the laboratories and drawing offices of:
THE ELECTRONICS RESEARCH LABORATORY
provides efficient lighting now and valuable flexibility for future changes. Designed by Ediswan Engineers in conjunction with Messrs. Fairbrother, Hall & Hedges, Chartered Architects, fittings use one or two tubular fluorescent lamps of any standard rating according to the local intensity required. The special CONTINUOUS channelling on which they are mounted gives the Engineer the facility of altering the position of fittings with any change in working conditions without disturbing the continuous channelling and consequently at minimum cost.
The channelling also accommodates service cables other than those for lighting and can mount loudspeakers and similar equipment. Besides economy of installation and maintenance, these extra advantages are the product of the basic simplicity of design developed by the experience behind the Ediswan Lighting Service, freely available for your lighting problem.

EDISWAN

Fluorescent Lighting Equipment

PUBLICATION No. LE 1788A ON REQUEST

THE EDISON SWAN ELECTRIC CO. LTD., 155 CHARING CROSS ROAD, LONDON, W.C.2

Member of the A.E.I. Group of Companies

LE 190

BUILD YOUR OWN with the DORMAN system

STANDARDISED UNITS
SAVE TIME, SAVE SPACE
SAVE LABOUR COSTS

The DORMAN SYSTEM offers full facilities for speedy and economical switchboard construction to individual requirements. A combination of high quality standardised components, complete plans of assembly and component lists and personal craftsmanship. Each component enables planned switchboard erection with a minimum of normal tools, minimum labour and all in a few hours —the simplest operation. The DORMAN SYSTEM ensures space saving symmetrical boards which can easily be modified or extended as required.

The switchboard illustrated was completely assembled and wired in 3 hours 17 minutes by a man and a boy.

SEND FOR LIST TS/C5
WHICH TELLS YOU ALL ABOUT IT

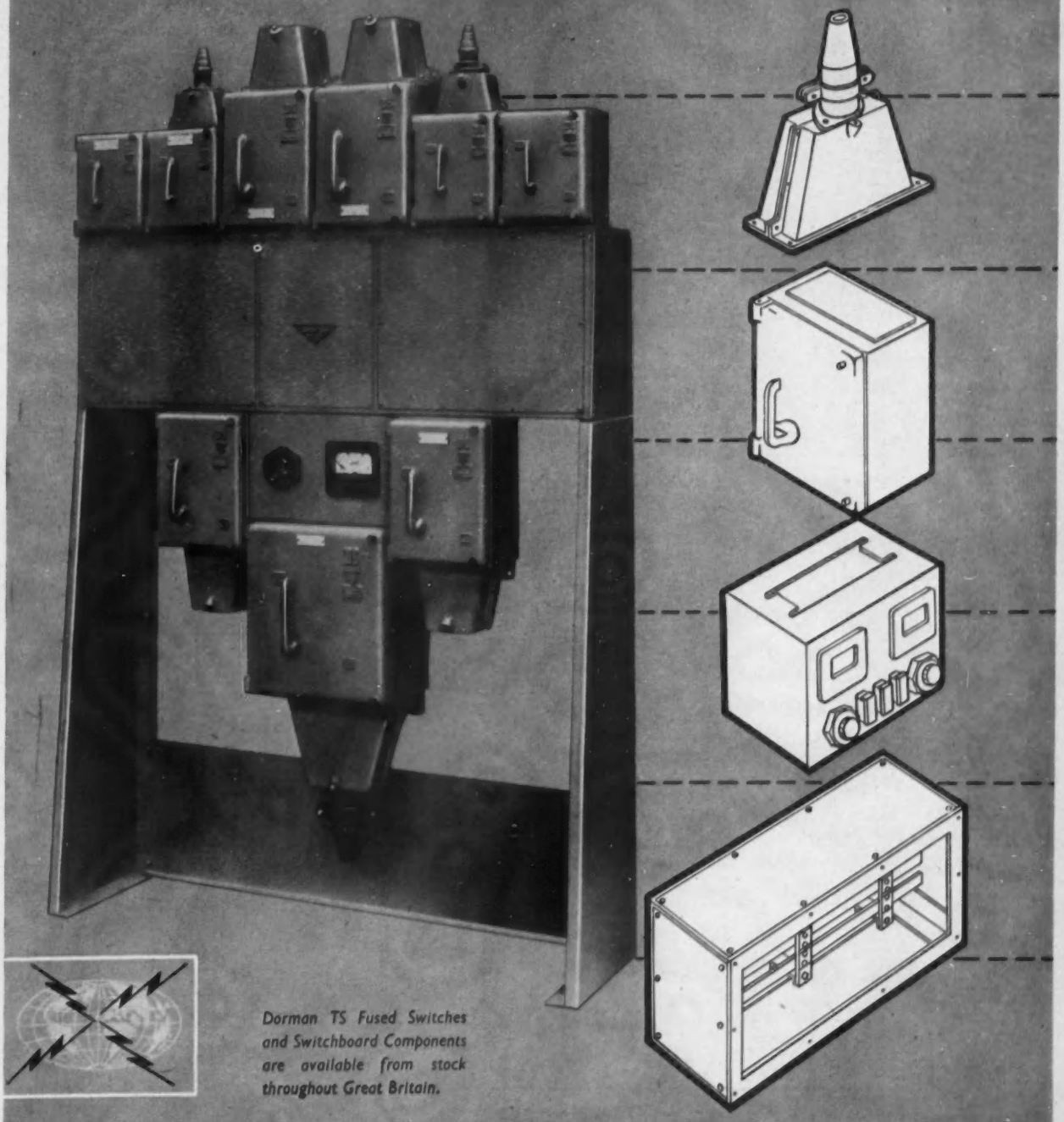
THE GREATEST DEVELOPMENT IN UNIT SWITCHBOARD ASSEMBLY

DORMAN & SMITH LTD.

THE WORLD'S BEST L.T. SWITCHGEAR

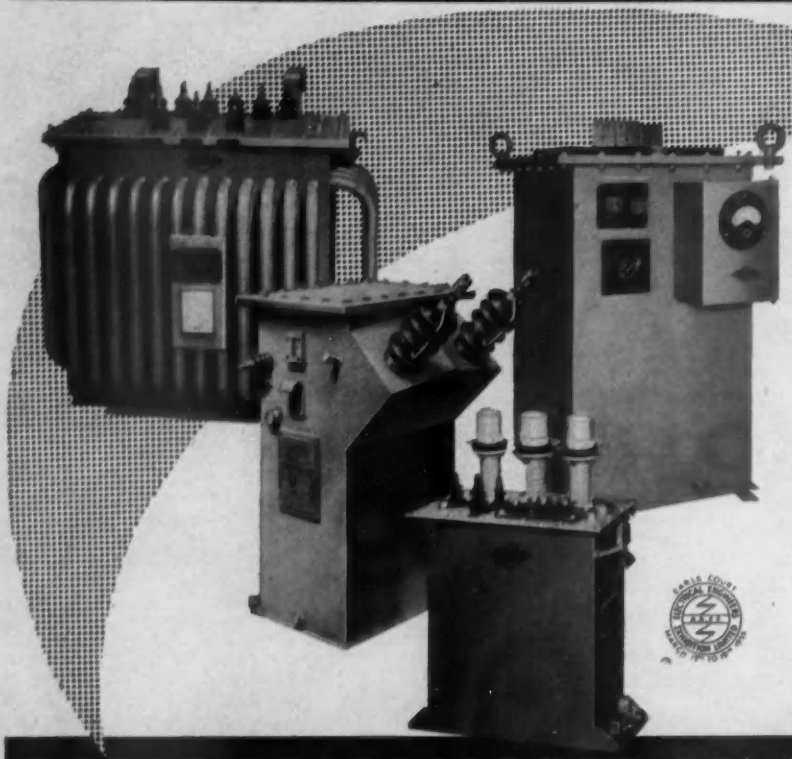
MANCHESTER LONDON GLASGOW BELFAST and JOHANNESBURG

SWITCHBOARDS



Dorman TS Fused Switches and Switchboard Components are available from stock throughout Great Britain.

See our exhibits at the ELECTRICAL ENGINEERS EXHIBITION, Earls Court, March 15th to 19th. STAND 199



WODEN TRANSFORMER CO. LTD

Transformers to 1,000 kVA

Every type of Industrial and Power Transformer is manufactured by Woden, including low-loss Rural Transformers for pole mounting and special types for Arc and Resistance Furnaces, transmitting equipment, rectification, electronics, screen heating and phase conversion.

Production and research is centred on the manufacture of reliable and accurate equipment at the lowest possible cost consistent with first-class materials and workmanship.

WODEN TRANSFORMER CO. LTD

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DON'T FORGET THE LIMPET TAPE

Such a handy thing to have—a roll of Connollys' Limpet Tape—its use on any job ensures long life and reliability, and its powers of adhesion enable it to be used with confidence for a wide variety of purposes—electrical and otherwise. Only the finest materials obtainable are used as ingredients in the adhesive compound.

We invite you to write for descriptive literature and samples of Limpet Tape

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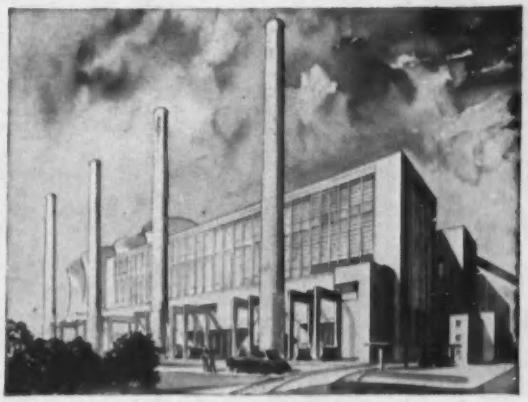
Taaibos POWER STATION

LARGEST BOILERS IN SOUTH AFRICA



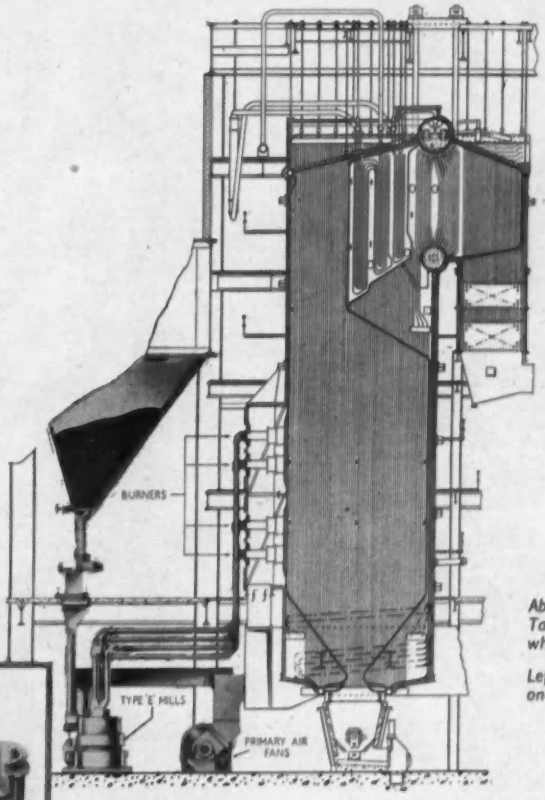
THE eight 580,000 lb./hr. Babcock boilers for the new Taaibos power station of tne Rand Undertaking*, of which the first units will soon be in commission, will be the largest boilers in South Africa.

Of modern, Bi-drum design, over 130 feet in height they are pulverized-fuel-fired, using low-grade coal from the coal field on which the station is being built; each boiler being served by four Babcock type E pulverizing mills, so connected to the sixteen horizontal intertube circular p.f. burners as to ensure even flame distribution at reduced loads, with one or more mills shut down.

Ash and dust handling are by the Babcock *Hydrojet* and *Hydrovac* systems.

Taaibos is a major undertaking in an impressive programme of South African electrical development, for which over 60 per cent of the steam-raising plant is being supplied by Babcock & Wilcox.

* *Electricity Supply Commission of the Union of South Africa.*



Above: Impression of Taaibos power station when completed.

Left: Arrangement of one of the boilers.

Sectional view of the Babcock type E pulverizing mill, with integral classifier, of which 32 are being supplied for Taaibos power station.

BABCOCK BOILERS

BABCOCK & WILCOX LTD. BABCOCK HOUSE, FARRINGDON ST., LONDON, E.C.4

UNION OF SOUTH AFRICA: BABCOCK & WILCOX OF AFRICA (PTY.) LTD. JOHANNESBURG

NEW ELECO "PERSPEX" FITTING FOR INDUSTRIAL CONDUIT LIGHTING

—Increases Light Output Ratio 10-15%

This new Eleco fitting (patent applied for) is efficient, versatile and economical. It can be used either open, or made completely dustproof with a diffusor cover. The reflectors are made in two grades of opal 'Perspex', whilst the covers are obtainable in three grades, including a pinspot pattern "Perspex". This means that a suitable combination can be arranged to control the percentage of upward light and brightness over a considerable area. Thus, units can be selected to give the best lighting effect for your particular installation.

TOTAL THESE FEATURES – AND YOU GET TODAY'S MOST EFFICIENT LIGHTING

For 100 to 500 watt tungsten Lamps, 80-125 watt MB/V Mercury.

Lighting output Ratio exceeds 85%. Balanced distribution — 10-25% upward light.

High mechanical strength — Resists corrosion.

Low initial cost.

Ease of installation.

White stove enamelled interior.

For further particulars or help on any lighting problem write to:

ELECO

ENGINEERING & LIGHTING EQUIPMENT CO. LTD.

SPHERE WORKS, ST. ALBANS, HERTS.

Photograph by courtesy of the South Eastern Electricity Board

J. & P.

TYPE FG

SWITCHGEAR

FOR RATINGS UP TO

500 MVA at 11kV

★

Typical of J. & P. Metalclad switchgear is this 6.6kV switchboard in the Rosherville Substation, Gravesend, of the South Eastern Electricity Board. It comprises two 1,600 amp. incoming transformer units with a 1,600 amp. bus-section, and six 800 amp. outgoing feeder units. This type of gear is available in compound-filled or air insulated form with arc control oil circuit-breakers for breaking capacities up to 500 MVA at 11kV.

JOHNSON & PHILLIPS LTD.

CHARLTON LONDON S.E.7

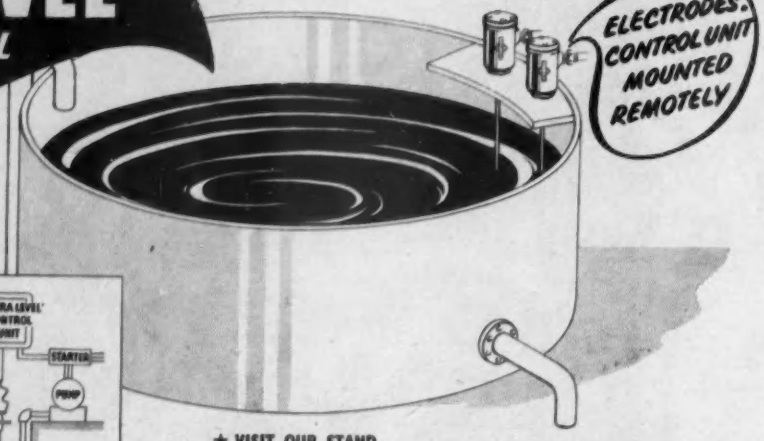
The mark that means that "little more" in quality

Automatically on the LEVEL!

LECTRALEVEL

FLOATLESS LEVEL CONTROL

★ FOR SIGNALLING
★ FOR CONTROL OF PUMPS & VALVES



The LECTRALEVEL floatless Level System is a simple foolproof method of controlling liquid levels by means of a small electric current and stationary electrodes. No floats are required.

The unit will maintain the level in a tank by controlling either a valve or pump.

This floatless system can be used for indicating purposes, operating lamps of different colours for low, medium and high levels. These signals can be combined with an audible and a self-resetting alarm cancelling device. Electrodes and holders available for all applications.

This unit incorporates neither moving parts nor electronic valves.

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No. 48 at the
ELECTRICAL ENGINEERS EXHIBITION

Write for new list 94/E.T.

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DEPENDABLE DELIVERY

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DOWNES & DAVIES LTD

The U.K. Atomic Energy Authority

selects

BRUSH MOTORS

for continual operation

(one year

without shutdown)

A large number of electric motors for driving centrifugal compressors has recently been built by Brush for the U.K. Atomic Energy Authority Industrial Group.

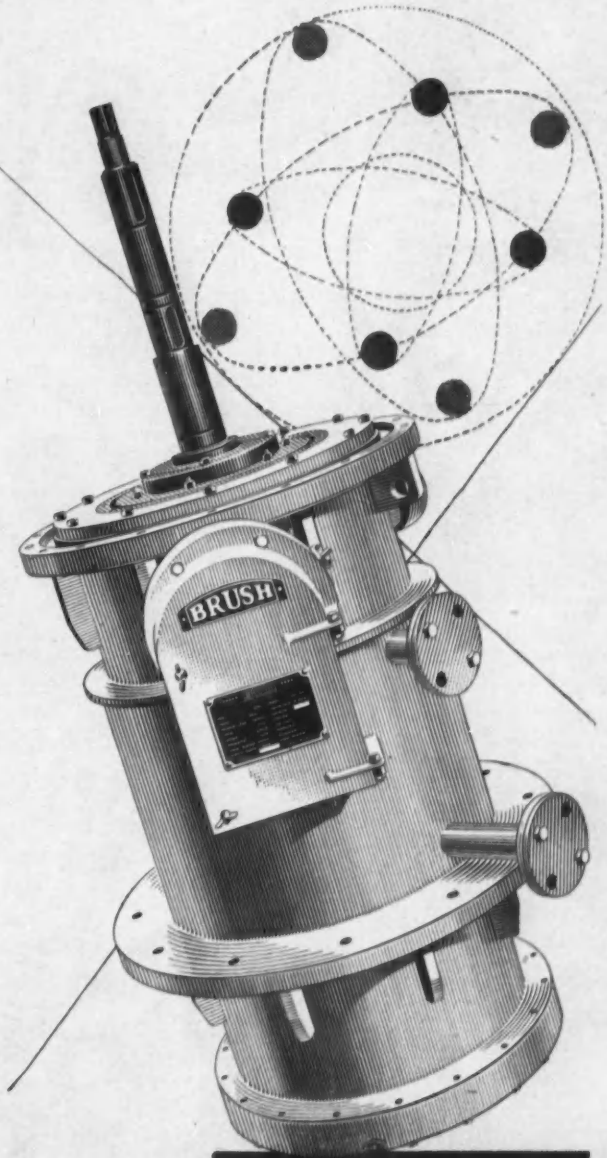
These motors have to comply with very stringent specifications — amounting to the highest standard of design and manufacture obtainable today.

One specific requirement is that the motors must be able to operate continuously — without shutdown, for ONE YEAR.

Each motor is rated for continuous duty at 2,965 r.p.m. operating on a 3 phase, 50 cycles supply, 415 volts. The aggregated horse power runs into tens of thousands.

Vacuum tight joints were also specified to permit operation when charged internally with nitrogen, at a low absolute pressure, and with an ambient air temperature similar to that of a greenhouse.

Deliveries were maintained strictly in accordance with scheduled requirements throughout the contract.



Whatever your Power problems . . . consult **BRUSH**

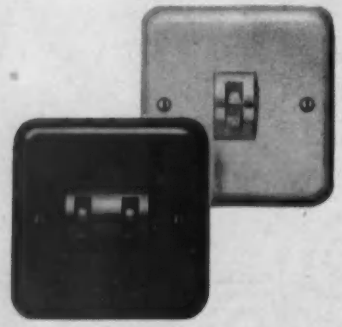
TRANSFORMERS · SWITCHGEAR · MOTORS
ALTERNATORS · GENERATORS · TURBINES

BRUSH BRUSH ELECTRICAL ENGINEERING CO. LTD. LOUGHBOROUGH, ENGLAND · MEMBER OF THE BRUSH GROUP

THE "LINCOLN" TYPE AC—A TRUE *PLASTER-DEPTH* SWITCH

Why not a plaster-depth Conduit Installation?

The cutting and chasing of brickwork can make an expensive business of conduit installation. But the "Lincoln" Type AC lighting switch with its extra-shallow steel box and grip entry for oval or round conduit greatly reduces this cost. The box fits flush to the wall, making possible a plaster-depth conduit installation when oval conduit is used. In this way, excellent earthing continuity is assured and the wireman's work is considerably simplified. When the advantages of the conduit system are combined with the high quality of the "Lincoln" Type AC lighting switch, the result is an installation that will give long and efficient service.



CRABTREE

WIRING ACCESSORIES • SWITCHGEAR • MOTOR STARTERS

"Crabtree" (Registered) *C702/7 Advt. of J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall, Staffs.*

H.V. Metal-Enclosed SWITCHGEAR

150 MVA at 3·3 kV
250 MVA at 6·6 & 11 kV

Type V1H, air-insulated. Type V2H, compound filled. Available for ratings of 400, 800 and 1,200 amps.

Please write for further information.

These three illustrations show the clean design. Cubicle doors open to allow breakers to be pulled forward on their trucks but, in addition, they can be readily removed from their hinges to give full access to the interior without obstructing the space in front of the switchboard.

METROPOLITAN-VICKERS
ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

Member of the A.E.I. group of companies

Leading Electrical Progress

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B

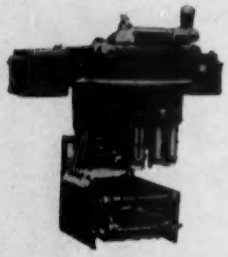
Specify 'Erskine Heap'

SWITCHGEAR and MOTOR CONTROL GEAR FOR YOUR NEW INSTALLATIONS...

May we have your enquiries?

THE SWITCHBOARD illustrated above comprises vertical isolation Switchgear of 15 MVA rupturing capacity for controlling three alternators with outgoing feeder circuits.

On the right is one of our combined type Stator and Rotor Starters with the tank removed. The combination of the Stator and Rotor contacts on the same drum makes the Starter completely foolproof; does away with the necessity of Interlocks and ensures a great saving of floor space.



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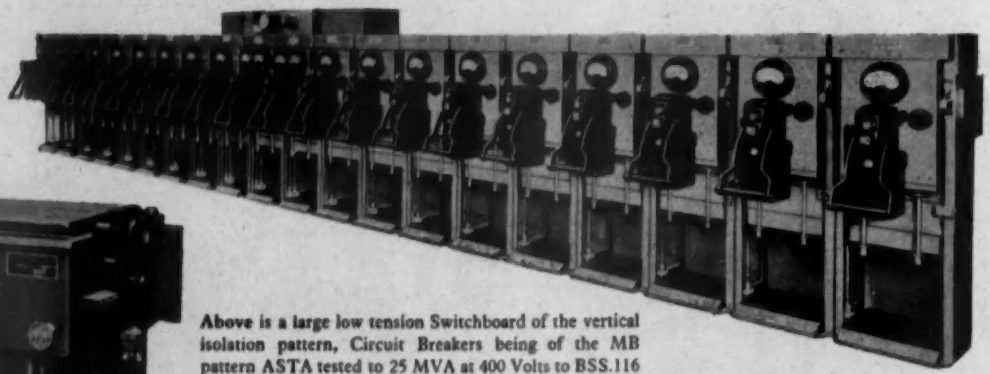

Above is a large low tension Switchboard of the vertical isolation pattern, Circuit Breakers being of the MB pattern ASTA tested to 25 MVA at 400 Volts to BSS.116 and is one of many Switchboards supplied through a Government Department.

Above is one of our SD.10 type Oil Immersed Star Delta Starters. This Starter can also be used for direct-on or series parallel starting, and in its Circuit Breaker form as a 100 Amp. Circuit Breaker.

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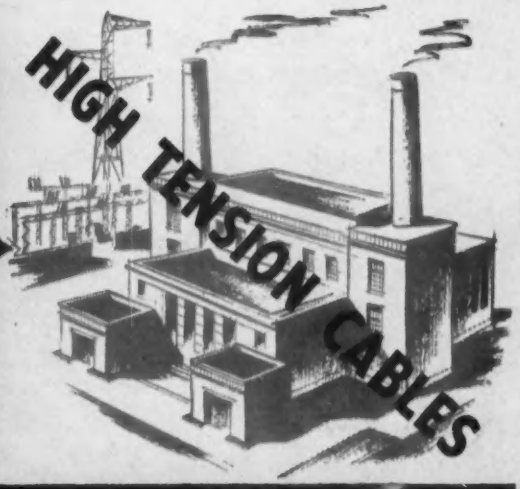

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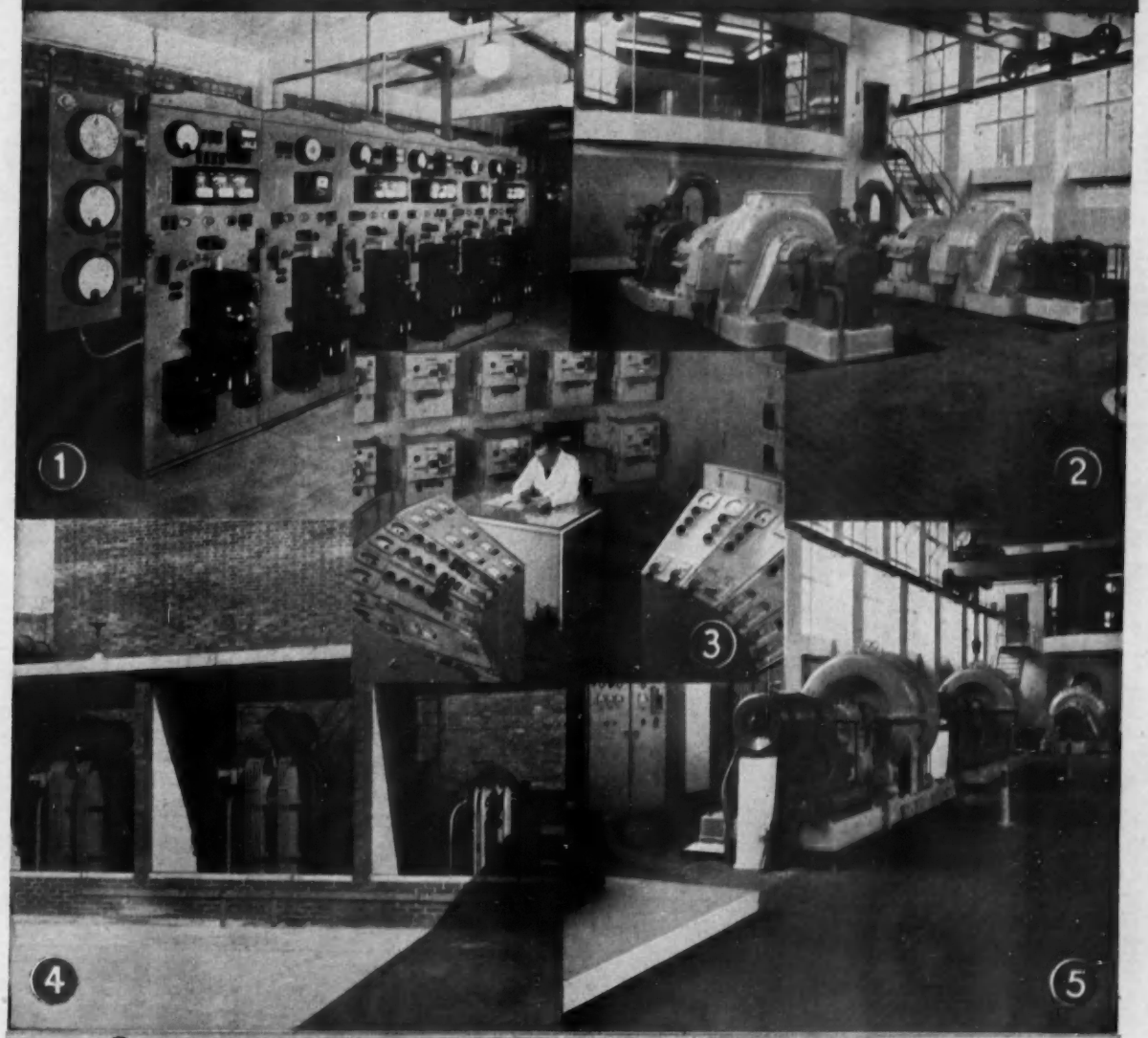

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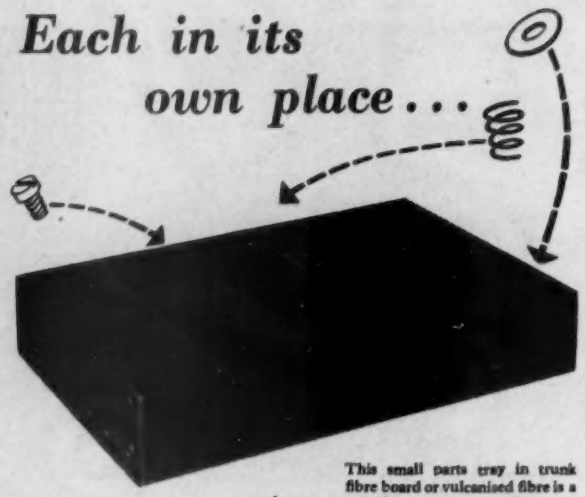

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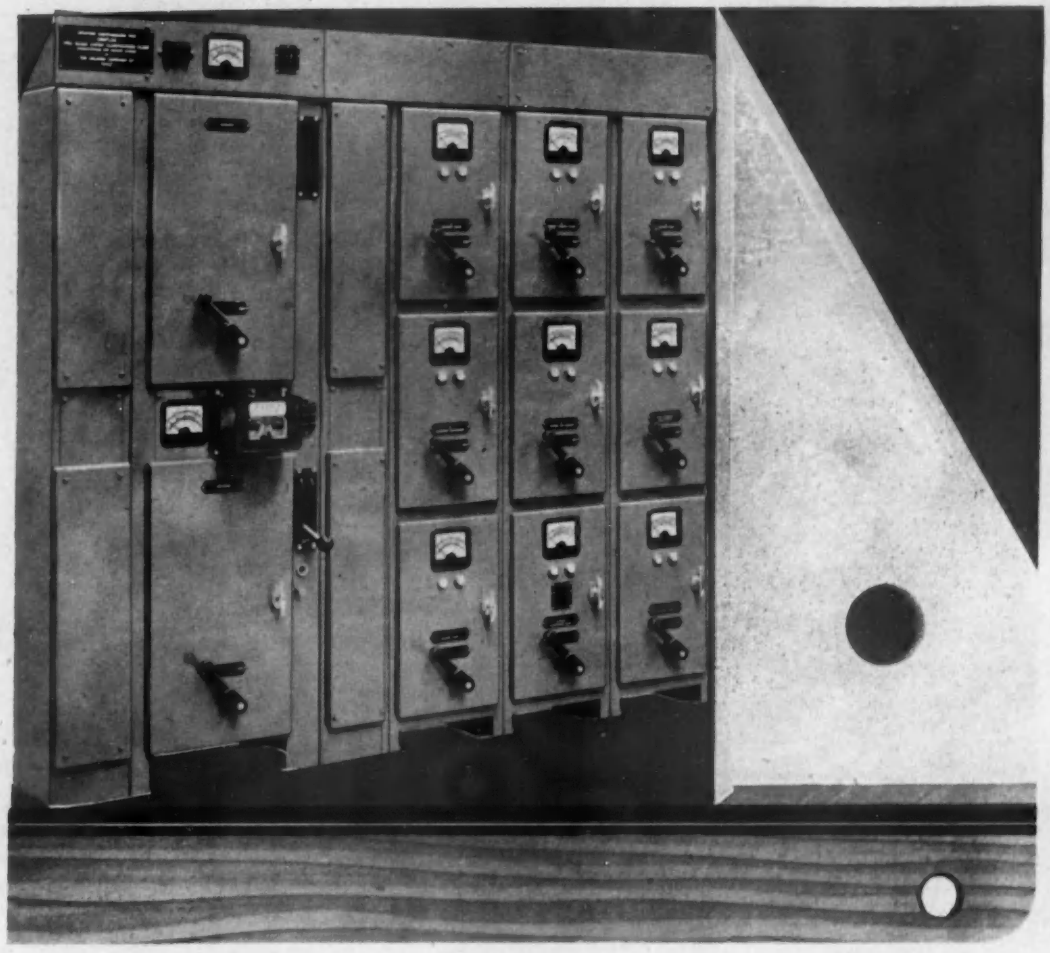

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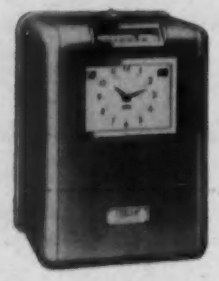
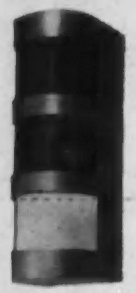
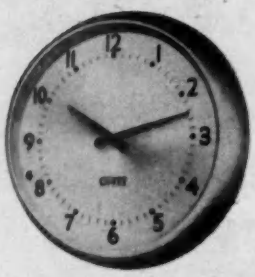

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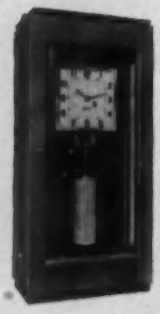

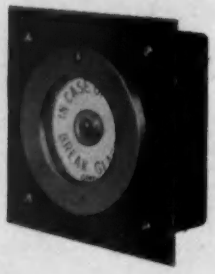

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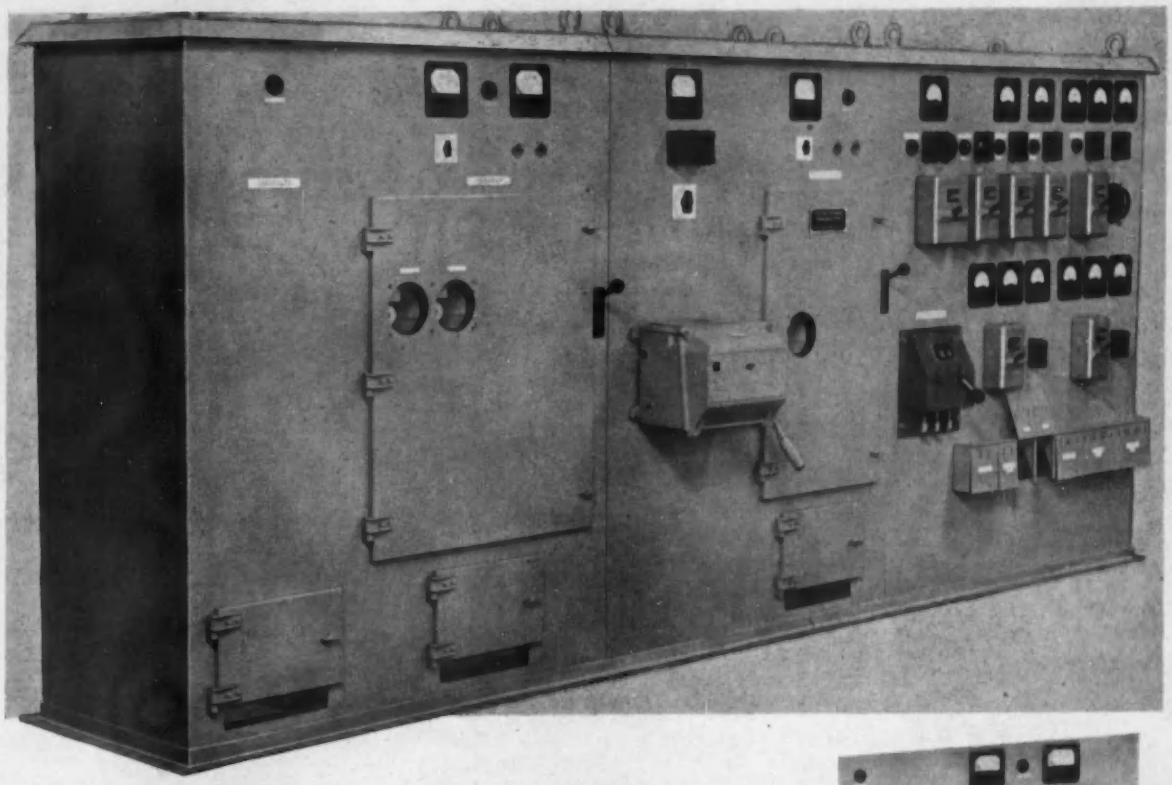

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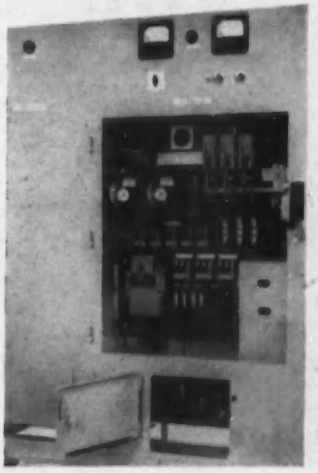

ABOVE: Part view of 20/60 H.P. section of panel, showing isolator; stator-contactor overload relay with range selector switch; earth leakage relays for HT and LT circuits and selector links. Terminals for Test leads under separate interlocked cover below.

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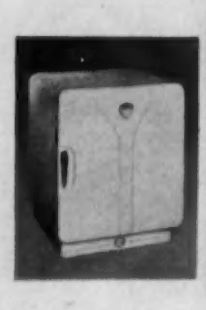

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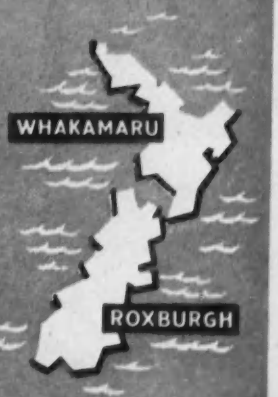

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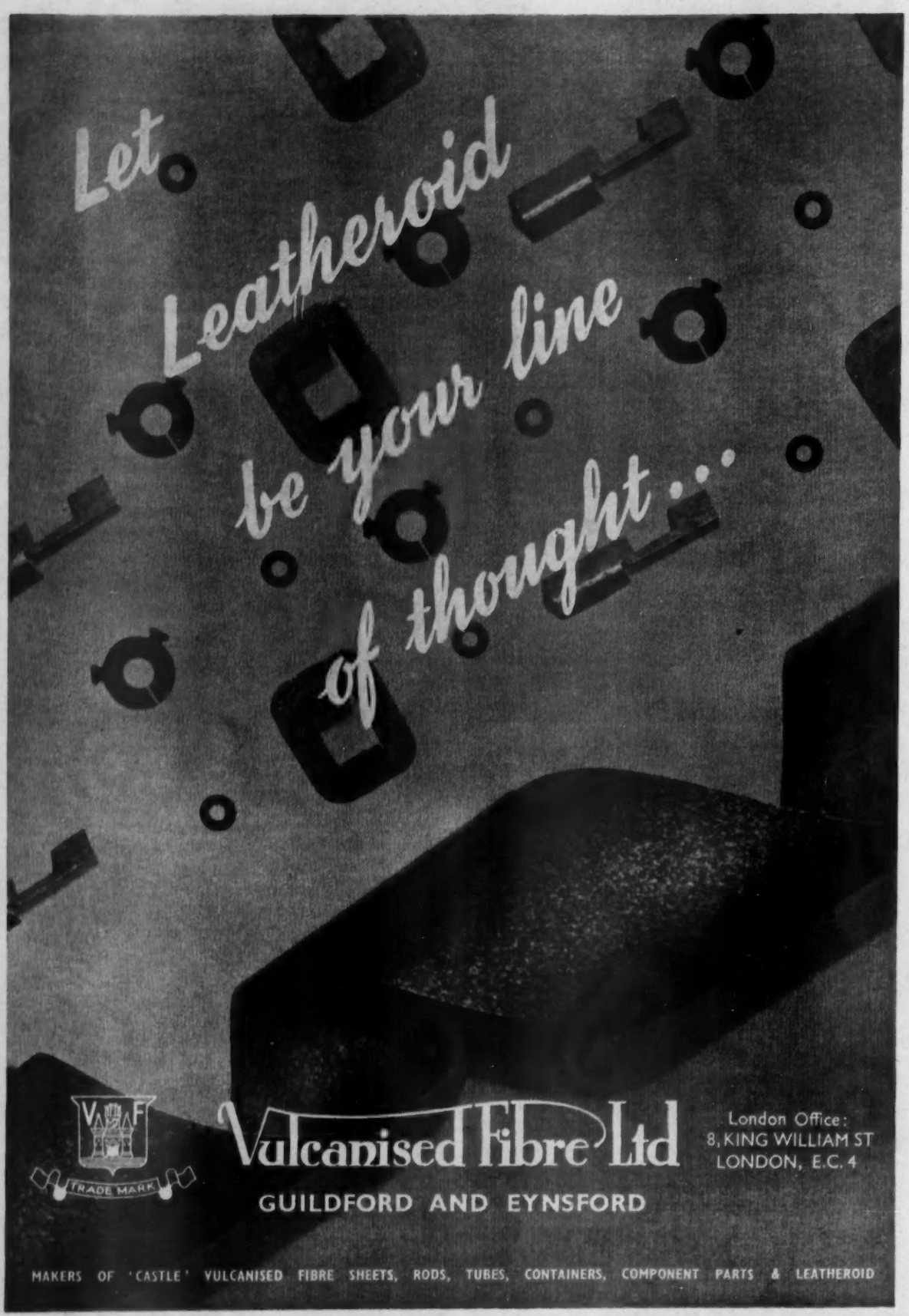
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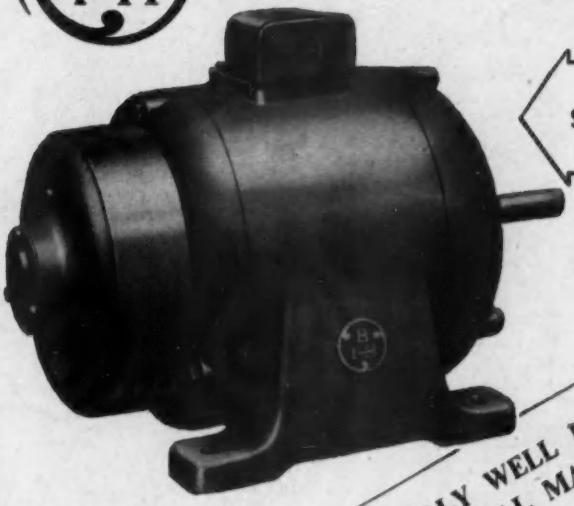

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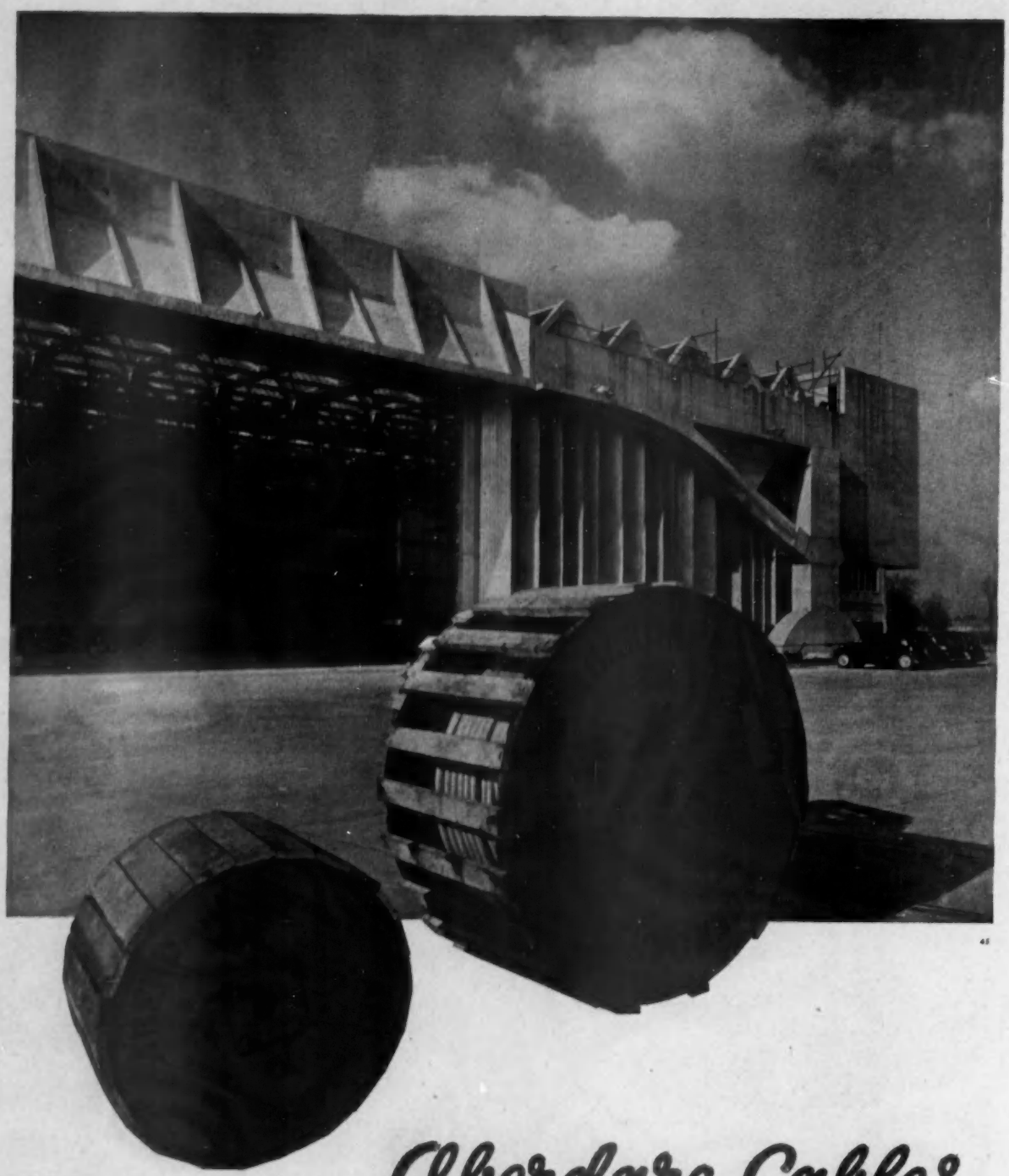

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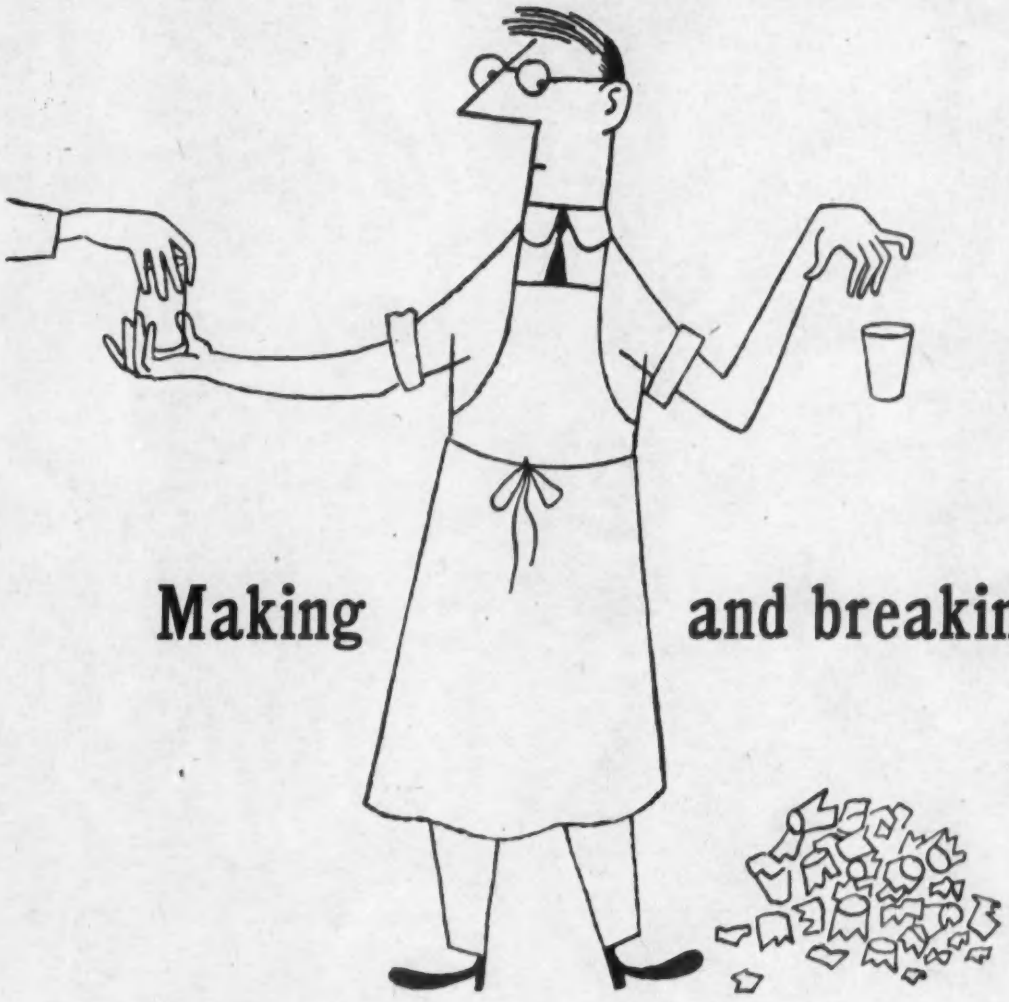

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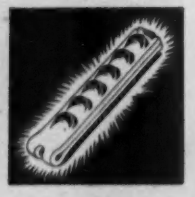

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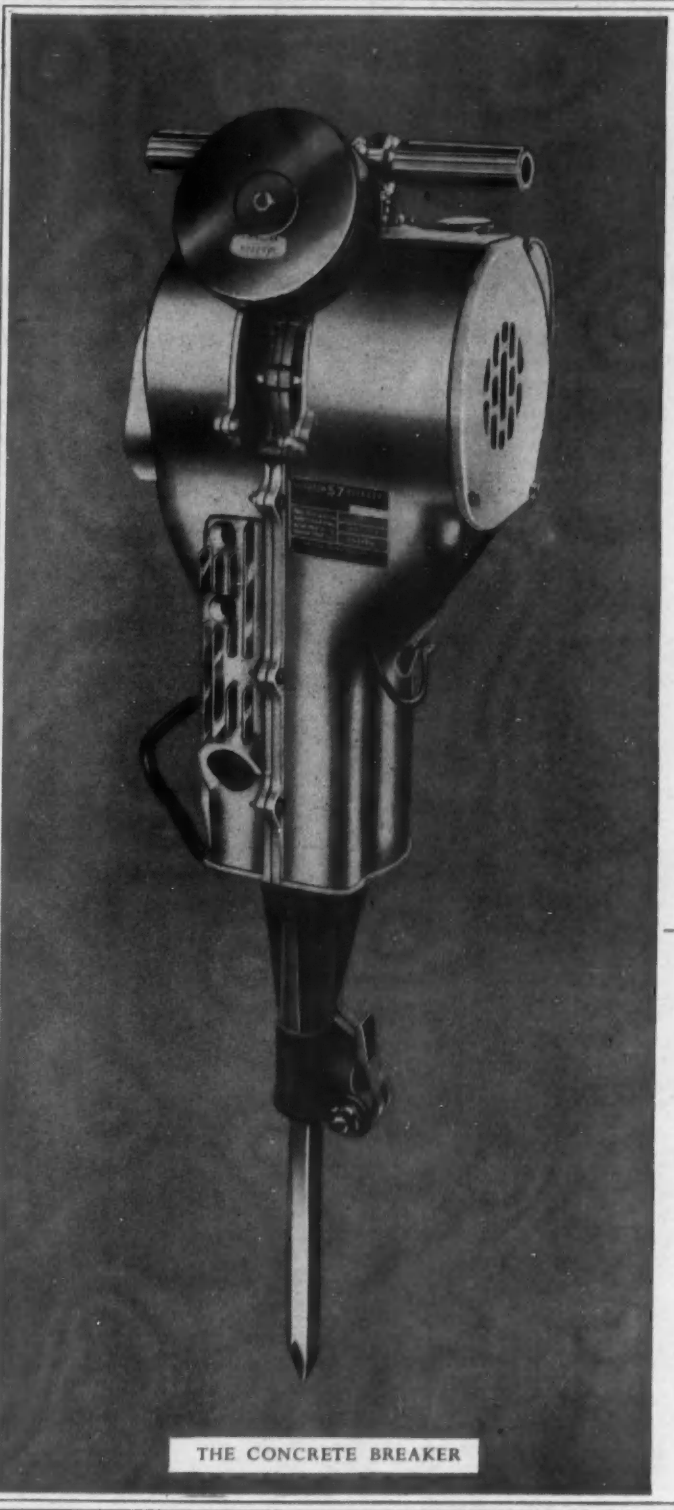

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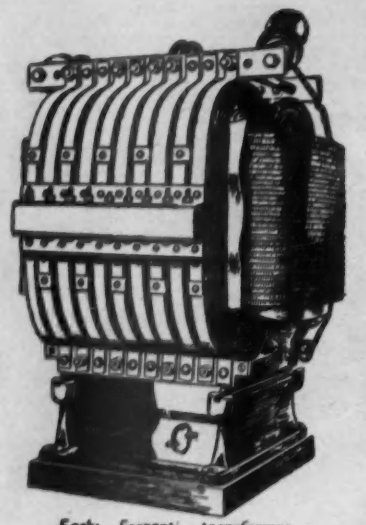

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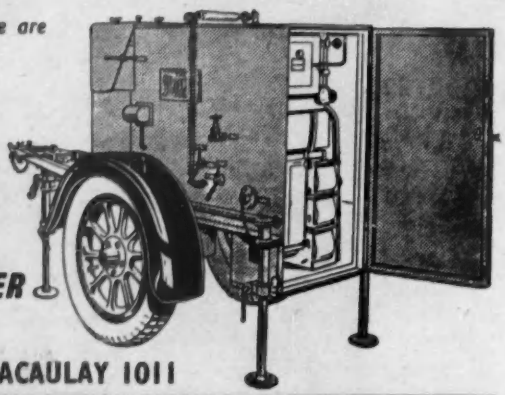

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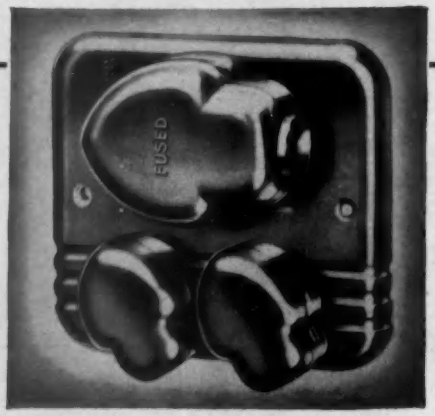

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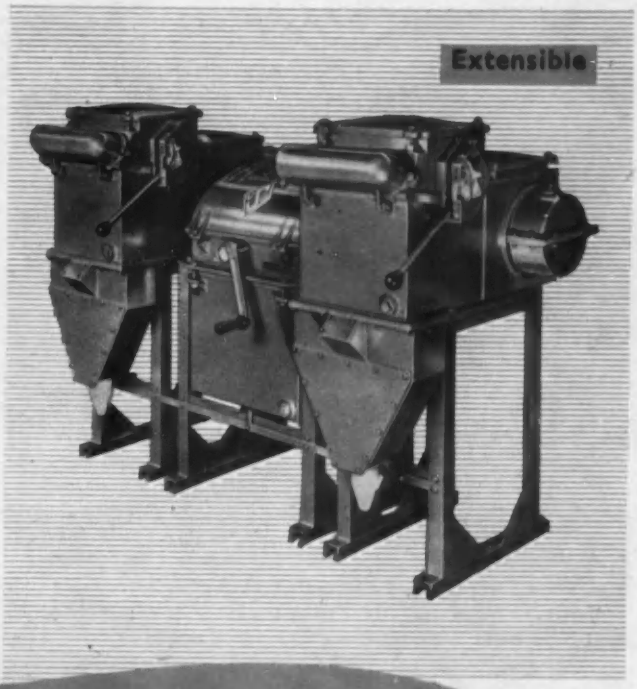

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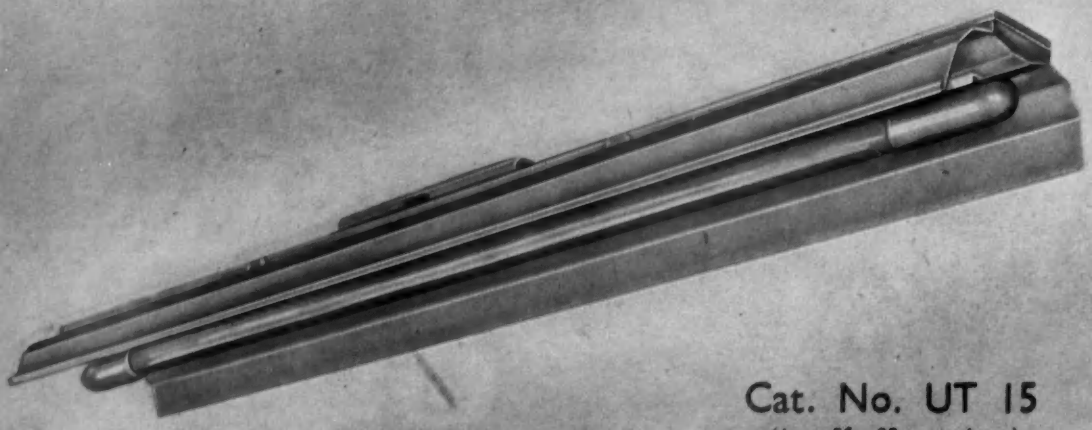

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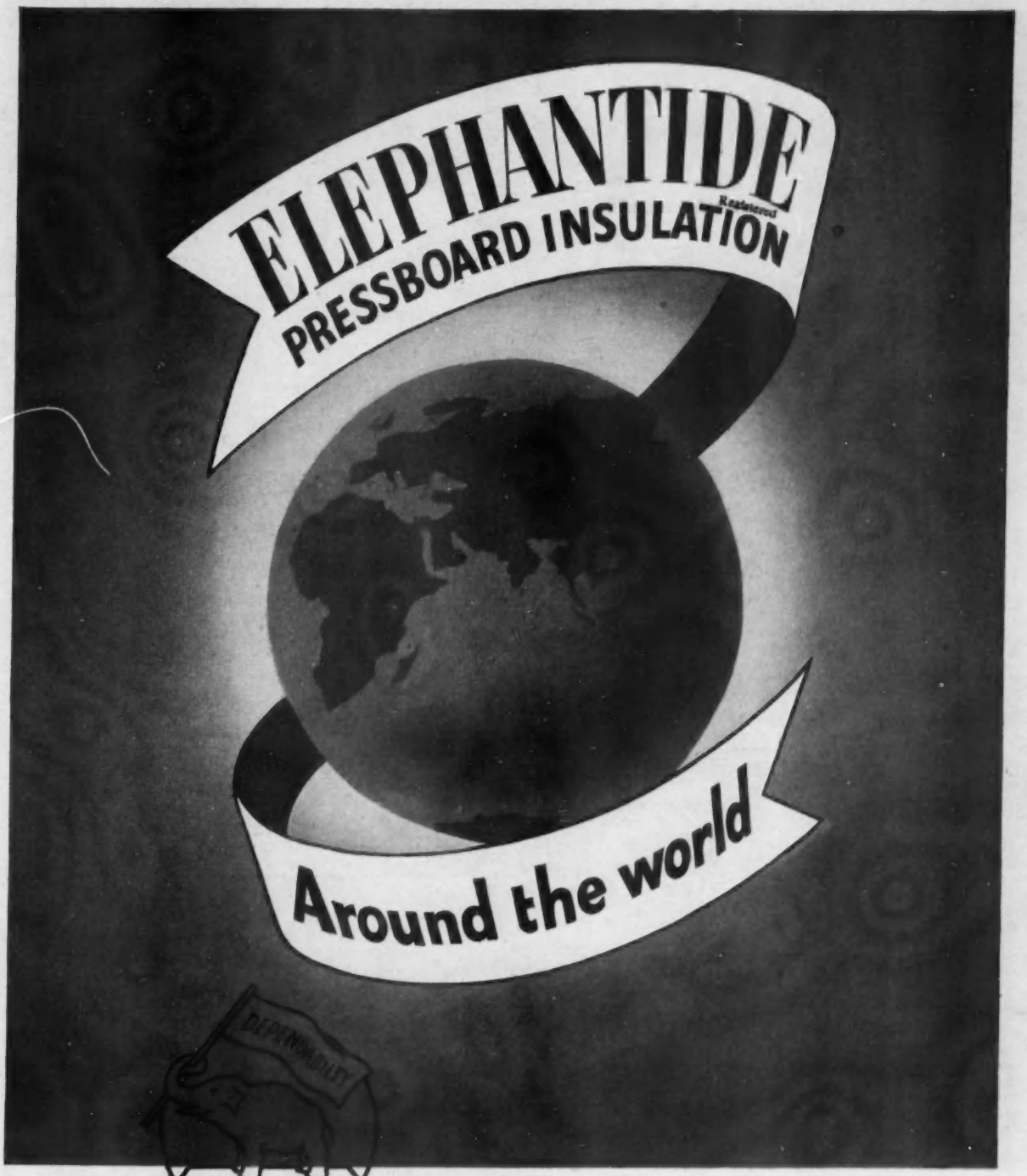

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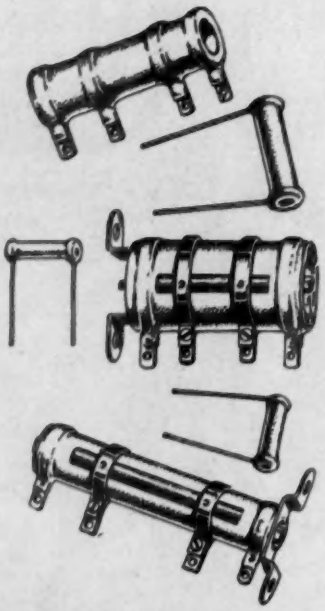

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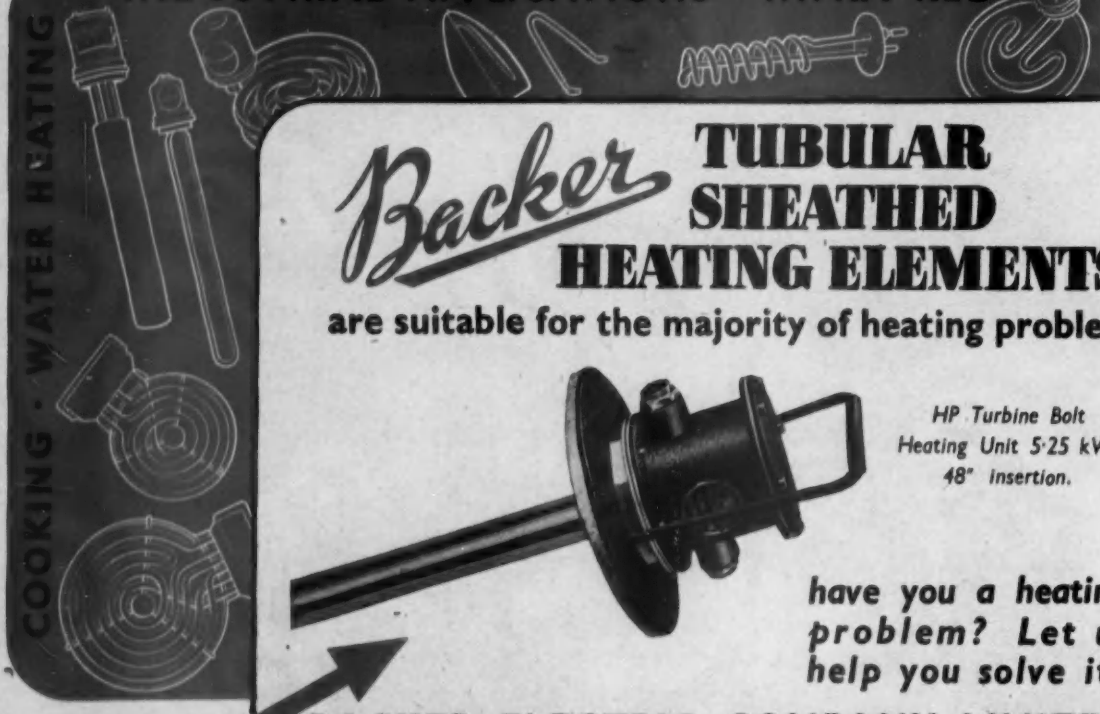

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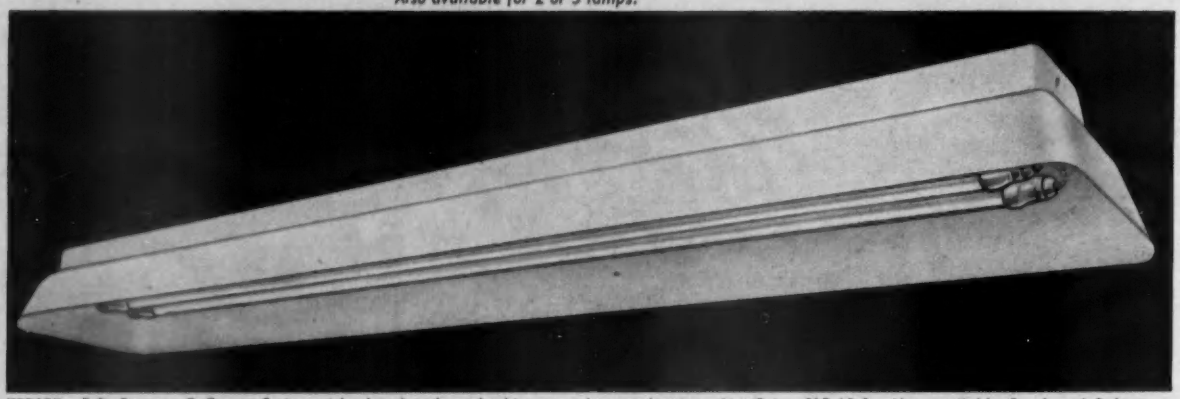

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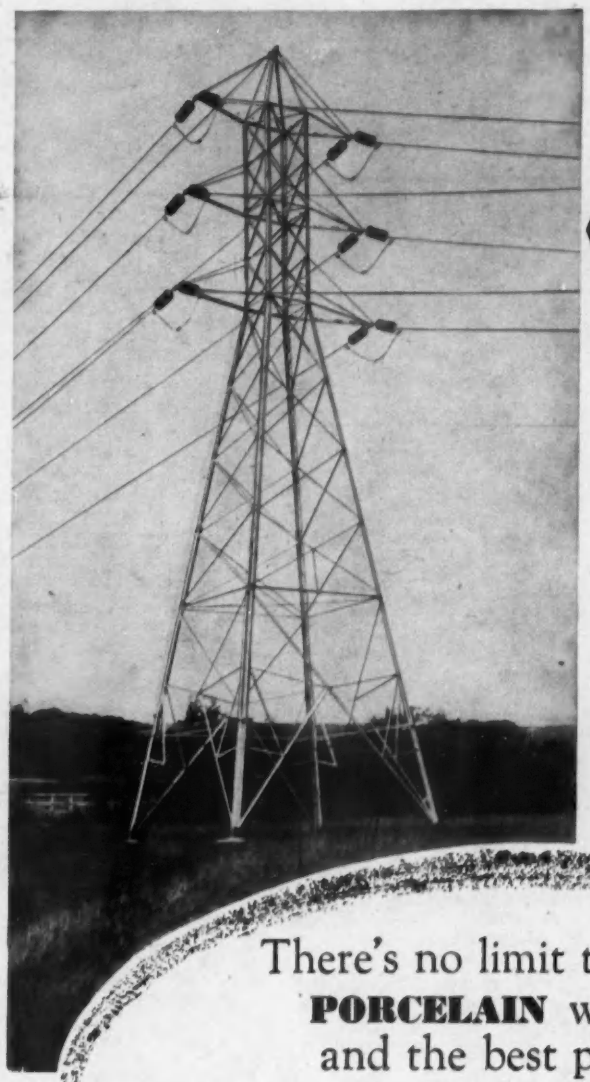

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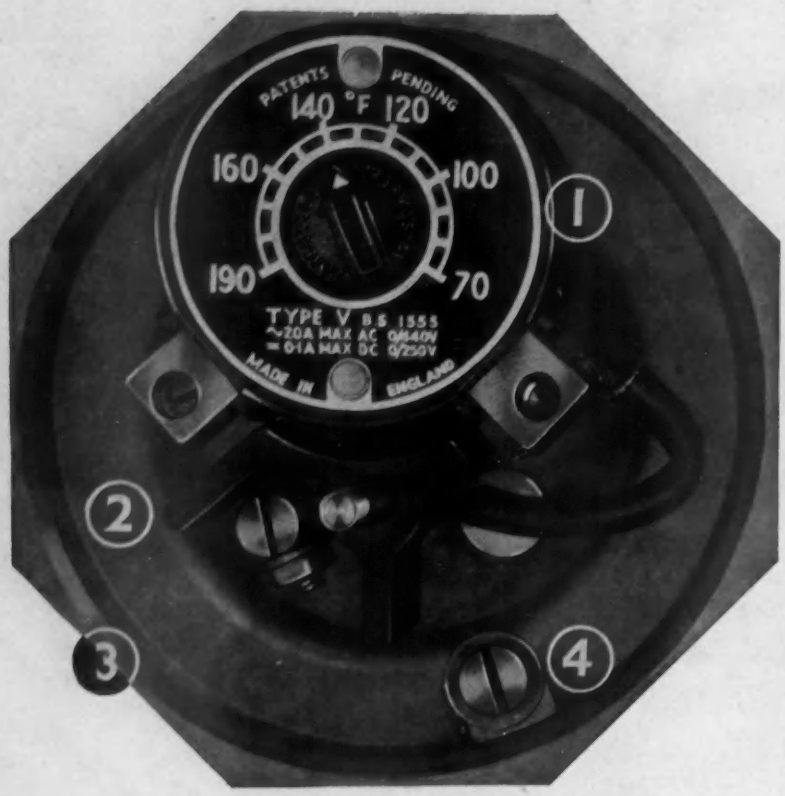

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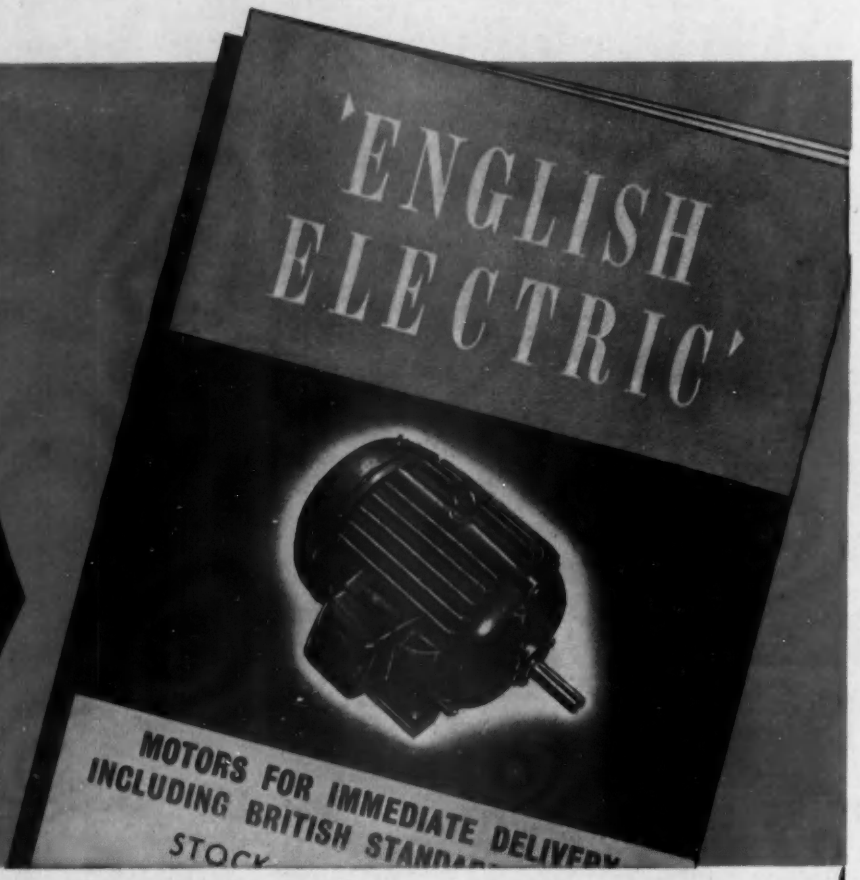

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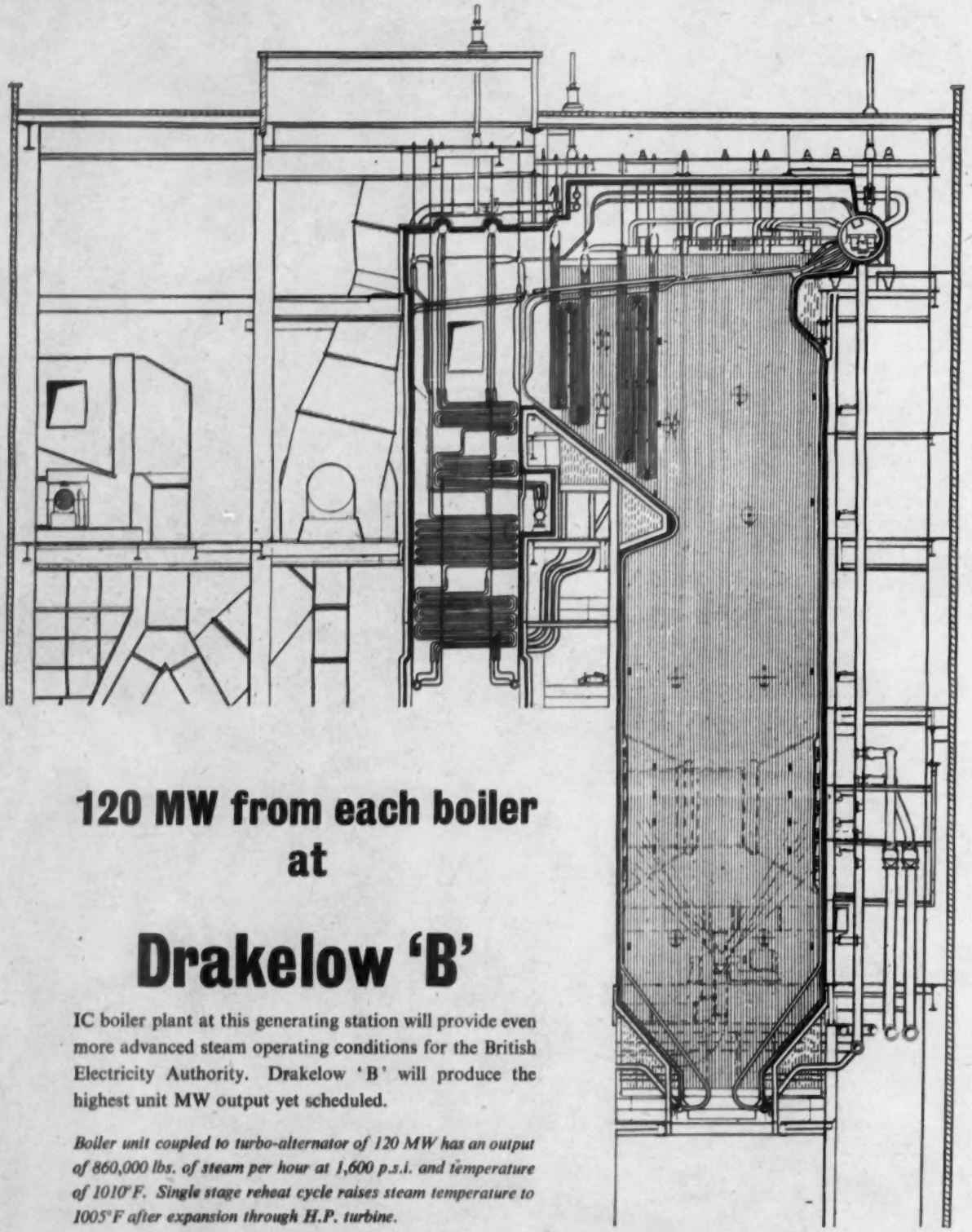

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ESTABLISHED 1891

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Editor and Managing Director:
ROY BALDWIN, M.I.E.E., Barrister-at-Law

Assistant Editors:
J. K. JOHNSON, B.SC.(ENG.), A.M.I.E.E.
K. C. POUNDS, B.SC.(ENG.), A.C.G.I., A.M.I.E.E.

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D

REGISTRATION BECOMES REALITY

It has taken almost six years to reach national agreement on the voluntary registration of electrical contractors. During that time there have been several promises of early success, and also some alarums signalling the possible collapse of negotiations. Now the long-heralded National Inspection Council for Electrical Installation Contracting is at last to be set up, and the statement issued by the Organising Committee this week gives real hope of rapid progress. Full details are unlikely to be available until the Council has been formally constituted, and has met to adopt the constitution and regulations that are no doubt already initialled in draft form, but some general lines of policy are clear from the statement now available. Above all, the voluntary principle that was at one time under heavy attack has been retained; registration is to be confined to firms rather than to individual wiremen. In consequence of this arrangement, the Council will not only have to ensure the maintenance of adequate standards by its members; it will have to give equal attention to the essential task of gaining public sympathy and support for its objects. With an imaginative approach in this sphere of its activities, the Council should be able to overcome such difficulties as arise from acceptance of the voluntary principle. But delay, otherwise regrettable, may have brought one advantage. The thirteenth edition of the I.E.E. Wiring Rules, with its promised new arrangement into a code conveniently worded for enforcement together with non-mandatory recommendations for good practice, should be available later this year to facilitate agreement on minimum standards.

INSURANCE AGAINST WINTER

An insurance policy for the area boards is written into the new bulk supply tariff, published by the B.E.A. last week. Under its terms, the B.E.A. will receive about £79m from the boards and other direct consumers for fixed charges whether the winter be uniformly moderate in temperature or marked by a sharp spell of intense cold, as it was in 1953-54. Each board will pay a proportion of the overall cost decided by the ratio of its simultaneous maximum demand to the total of all such demands. The change is likely to be readily welcomed by the area boards, who were hard hit by weather in 1953-54. It is indeed a logical development, for it charges the area boards with the cost of the assets held on call for them, and relegates the chance effects of weather to the return from energy consumption alone. Moreover, as peaks in extreme weather are much influenced by consumers, domestic and commercial, who do not pay on a maximum demand

tariff, the change brings a common pattern into area board and central authority tariff structures. As a result of the alteration, a new element of flexibility is introduced into the bulk supply tariff. The £79m quoted is made up from the estimated aggregate demand of 16,630,000 kW chargeable at £4·15 per kW (in considering this figure it has to be borne in mind that the Scottish boards will have been severed by the time the tariff comes into force). In future, the effective price per peak kilowatt will be open to modification not only by altering the base price, but also, should it become necessary to make fine adjustments, by manipulation of the "expected" aggregate demand.

FULL STEAM ON NUCLEAR POWER

The most important announcement yet on nuclear power generation was made this week when in a Government White Paper particulars of the future programme of commercial power development were outlined. For some time now a highly optimistic note has been detectable in statements made by those closely identified with power projects. This is justified by the 10 year programme comprising 2,000 MW of plant in twelve stations of successively improved efficiency, at a cost of £300m. This ambitious programme underlines the way this country has seized the initiative in commercial applications of nuclear power. Unfortunately, the announcement of the new proposals came too late to allow time for proper analysis in this issue, and therefore we shall return to the subject next week. We can welcome the statement, however, as revealing the confidence of all those associated with the nuclear project in their ability to provide nuclear power at a competitive price, from the time the first stations are operating, in 1960 or 1961, and to begin to show real savings compared with coal by the end of the programme.

EXPERIENCE FROM TORONTO

It is with commendable promptness that Sir Claude Gibb has presented publicly an account of the investigations following the two failures of the 100 MW generators at Toronto. The electrical engineering world has been awaiting this report with considerable anxiety, as the consequences of two virtually coincident breakdowns affecting two such large machines must necessarily have some repercussions not only on British prestige but also on technical advancement throughout the world. Such breakdowns are, nevertheless, a risk which is ever present if progress is to be made. The demand for the highest efficiencies allied to economic prices which in turn implies ever-larger units, imposes problems on the machine designer of great complexity, for existing materials tend to become stressed toward the working limit. When in addition, the design must be capable of undertaking the most onerous duties such as two-shift working—and the Toronto machines operated on such a routine and were frequently run up and synchronised in under half an hour—it is inevitable that factors not readily amenable to calculation and normally of small effect in their own right, should begin to play an increasingly significant part. Such factors were, according to the paper, present in the non-magnetic steel of which the end-bells of the Toronto sets were composed. Recent developments however, some of them as a direct result of the investigations, both in the metallurgical field and in the design of cooling systems of rotors, have altered the picture, and non-magnetic steels made with new techniques and with their inherent electrical advantages are suitable for machines of 100 MW and above.

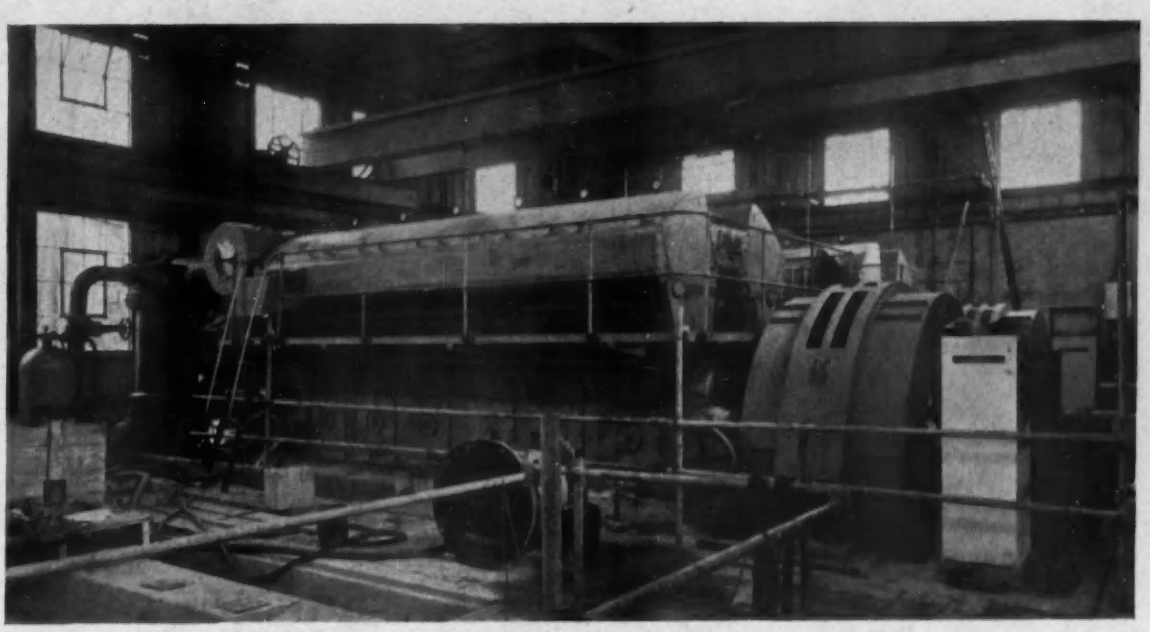
FUTURE FOR EUROPEAN SUPPLY

Some slowing down of the rate of increase of electricity generation in Western Europe during the next five years is forecast by the Organisation for European Economic Co-operation in its latest study of the supply industry in member countries. Detailed consideration of the plans of each country, summarised on a later page, suggest that the phase of rapid expansion to compensate for the lost war years is now over: as in Great Britain, installed capacity throughout Europe has at last become reasonably sufficient to meet all normal demands. The 9% per year rate of increase in unit sales that has prevailed since 1945 is expected to decrease to 6%, and this lower figure will be accompanied by some change in accent of engineering effort. Distribution and transmission, to some extent neglected during the years of generating plant shortage, will, in particular, receive increased attention. Yet the forecast has of necessity ignored the biggest change that is likely in the foreseeable future. It quite correctly leaves out of consideration nuclear power stations, for they will be strictly experimental during the period it covers. By the end of 1958, however, as the British White Paper shows, they should be yielding significant results about the probable future economy of nuclear generation. If the results are as favourable as the industry hopes, 6% may stretch by the mid 1960's into 9% or higher once again.

REPLACEMENT NEEDS PERSUASION

In a survey of trading prospects for 1955, our American contemporary, *Electrical Merchandising*, stresses that retailers there are selling in a replacement market. Over the past three years, over two-thirds of refrigerators and washing machines sold and over half the electric cookers went to homes already owning such major appliances. The saturation figures which the same paper quotes for these appliances are 92·4%, 81·2% and 27% respectively, based on wired homes. These figures are in two cases, at any rate, well in advance of those that would apply in this country, and to that extent they are a measure of opportunity. More immediately, however, the replacement proportions underline the twin problems that in the long run will face both retailers and manufacturers in this country. For retailers, the immediate difficulty becomes that of encouraging new purchases by the selective granting of allowances for the appliances to be replaced, and of dealing with such unwanted stock economically. Perhaps manufacturers face the bigger problem however. In a replacement market they will have to style with advanced imagination if they are to persuade British customers to do away with existing equipment, and for the establishment of an effective "fashion" in appearance they will have to add real advances in convenience and efficiency.

Meteor



BEA's Largest Diesel Station

Ashford "B" to have an ultimate capacity of 10 MW

ASHFORD, Kent, has only a comparatively short history in electricity supply, the authorising order giving powers to the Ashford Urban District Council having been granted in 1925. The first electricity was supplied from Ashford "A" station in 1926. This station contained at its maximum, three 600 b.h.p. Ruston vertical heavy oil engines coupled to three 400 kW English Electric alternators, and one 600 and one 800 kW Davey Paxman oil engines together with one Ruston 900 kW set again coupled to English Electric alternators, to give a total capacity of 3·5 MW. This was the situation at the outbreak of war.

After hostilities had ceased a certain amount of down-rating took place. The 400 kW Ruston machines becoming 300 kW, the 900 kW Ruston set becoming 700 kW, and one of the Davey Paxman sets was taken out of commission, the remaining one being rated at 450 kW, to give an overall capacity of 2·05 MW.

Following nationalisation, when it was decided due to plant shortage to embark on a restricted programme of diesel plant installation, Ashford, with land available and with experience of diesel operation, was selected as one of the appropriate sites, and a new station, Ashford B, is now well advanced in construction, and is already generating.

The new station lies to the west of the old, and is located on low lying ground to the south of the centre of the town. It will have an ultimate capacity of 10 MW in five 2 MW sets.

The foundations are comparatively straightforward consisting of a concrete tank forming a raft containing five individual mass concrete foundation blocks which are isolated from the tank and building structure by anti-vibration layers of "Conesil" and cork. Building costs have been kept down to a minimum by the extensive use of asbestos-cement preformed panels which comprise the major part of the wall area and the roof.

The heading photograph shows No. 2 generating set with foundations for No. 3 in the foreground

To the south of the station has been built a wooden induced-draught cooling tower which cools the secondary water system of the diesel-engines, and to the north of the station is the fuel storage compound which contains four main fuel tanks, each holding 25,000 gallons of fuel oil and one tank containing a lighter fuel oil for starting purposes. A further tank holds lubricating oil. These oils are being at present supplied by Berry Wiggins and Co. and are "Chevron" brand types. For running it is proposed to use medium fuel oil, 200 secs—an exceptionally heavy grade for diesel working, and the main tanks are consequently lagged and have heating pipes, running off the cooling water system built in them. Starting will be by normal diesel oil, and lubrication by Chevron Fulmar MIL 30. Oil, both fuel and lubricating, is delivered by road tanker from the refinery at Kingsnorth, near Rochester.

Prime Movers

The five diesel generating sets are transversly placed along the station length. At the moment both Nos. 1 and 2 units are on load, although they are still operating with the lighter diesel fuel oil, not yet having been transferred to the heavier grades. The third, fourth and fifth sets are due for commissioning in time for the 1955-6 winter load.

Manufactured by Mirrlees, Bickerton and Day Ltd., the diesels are KVSS 12-cylinder, pressure-charged engines developing 2,904 b.h.p. at 428 r.p.m. This type of machine, which has only been in production for 2 years, is of the four-stroke cycle and has an open type combustion chamber with direct fuel injection. The "Vee" angle between the two banks of six cylinders is 45°.

"Bryce" fuel injection pumps and atomisers are used. Each pump is mounted separately at the base of each cylinder as this position gives short equal lengths of pipe between the pumps and injectors. Fuel injection can be independently adjusted at each pump. From the daily ser-

Induced draught cooling tower to south of station being constructed. This was designed by Film Cooling Towers Ltd.

vice tank, fuel oil passes through a gauze filter in the tank and then through a Duplex filter fitted on the engine.

A centrifugal type governor, mounted at the flywheel end and driven through gears from the crankshaft, can be controlled to give a speed adjustment of 5% above and 10% below normal engine speed. Protection is provided against failure of oil pressure and overspeed should the normal running speed be exceeded by 15%. Twin "Buchi" type exhaust gas-driven turbo-chargers and twin intercoolers for cooling the air after its passage through the superchargers are provided.

Starting is by means of compressed air through the master starting valve and patented timing valves, and the engine can be instantly run up from cold. Operation is by a single hand control wheel which has three positions, "start," "run" and "stop." The nominal starting air pressure is 300 lb/sq in.

Fuel consumption is estimated at 0·345 lb/b.h.p.-hr. at full load; 0·350 lb/b.h.p.-hr at three-quarter load and 0·372 lb/b.h.p.-hr at half load.

Generating Plant

Electrically the system is not complex. The alternators, directly coupled to the diesels are of Brush manufacture and are rated at 2,000 kW, 428 r.p.m., 0·8 p.f. 6·6 kV. Voltage regulation of each unit is provided by a Metropolitan-Vickers vibrating type unit, which is associated with the field suppression cubicle mounted alongside the direct coupled exciters at the outboard end of each machine. The outgoing alternator feed is taken via cables to a 6-panel, 6·6 kV Brush VA5 switchboard. Five of the switches control the alternators, the sixth being available for connection to the station transformer. Each machine is thus switched on to a common 6·6 kV busbar and outgoing power is taken via a reactor from this bus system to the South Eastern Area Board's Reyrolle switchgear to which the 6·6 kV bus in the "A" station is also connected.

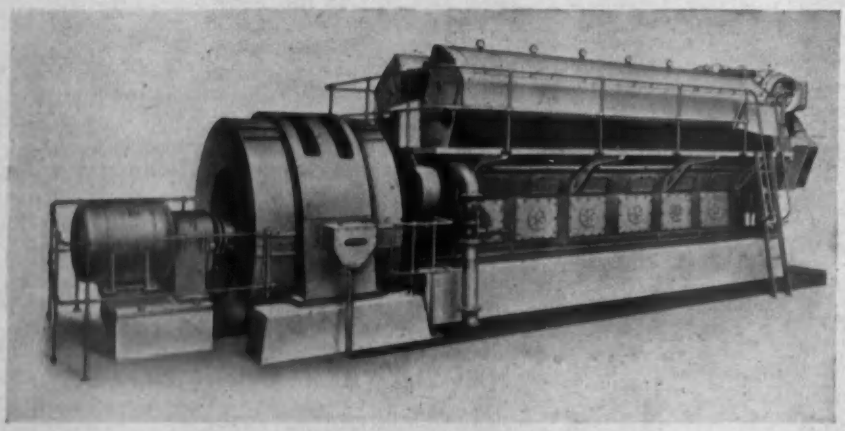
Control of the generating sets is exercised from a position centrally located on the south side of the engine room, where a 5-panel control board is located, together with a synchronising panel which is common to all the sets. The manually-controlled field rheostats are accommodated on these panels, together with indicating instruments, circuit breakers and governor control switches indicating lamps and synchronising plug sockets. On the right of the control board are the alternator and house transformer circuit-breaker panels with protection relays. In addition there is a single neutral earthing cubicle.

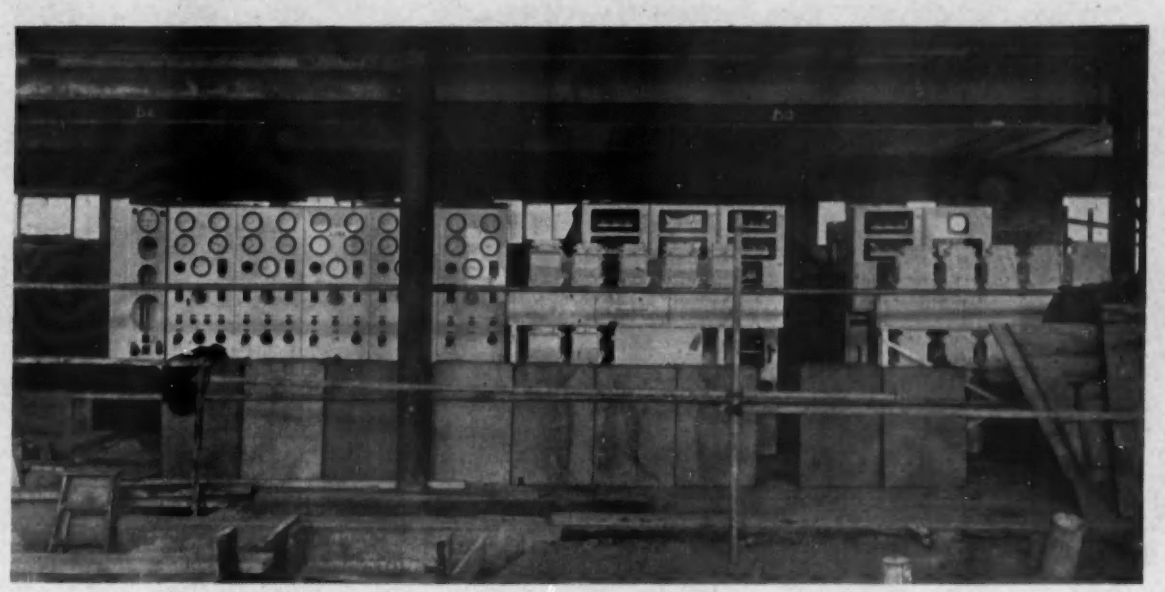
Connection with the grid system is made via 33 kV overhead lines to Folkestone through two banked transformers each of 5 MVA together with a 10 MVA transformer, all being fitted with auxiliary forced air cooling, and supply is also provided to the South Eastern Electricity Board's substation which is alongside the generating station.

Auxiliary switchboards, of Brookhirst and English Electric manufacture control the ancillary supplies and motors which, as would be expected in a diesel station, are few in number. The principal items on this side are the induced draught fan motor in the cooling tower, water pumps for c.w. make-up, centrifuge for oil purification, compressors and oil pumping plant.

Although fundamentally the plant is designed for use at time of peak load and emergency—as it can be started up and put on load at extremely short notice—it has in fact been operating for quite long periods per day and is working with a fairly high load factor.

A typical KVSS 12 cylinder 2,000 kW diesel alternator as installed at Ashford





Control panels with main and auxiliary switchboards in course of erection

The Ashford "B" installation is of course only one of the stations in which diesel plant has been installed or added in recent years. Other units in 1954 comprised 1 × 200 kW at Alderley Edge, 2 × 2,000 kW at Barugh, and 2×2,000 kW at Buxton, all Mirrlees Bickerton and Day. At Blackpool five 1,280 kW Harland Wolff sets were installed. While both Clacton and Southend had one 950 kW English Electric set each. Ruston and Hornsby were responsible for 1×1,040 kW set at Newbury and Crossley Bros for 2×1,220 kW sets at Haverford West.

Our thanks are due to the Divisional Controller, South Eastern Division, and to the station staff for this article.

Circuit-Breaker Performance

WHEN air-blast circuit-breakers are operated at reduced pressure an increasing probability of failure to clear develops as the pressure becomes less. The "clearing" or "failing" under these circumstances is not readily assessable except by the carrying out of a large number of tests in which, as far as possible, the air pressure is made an independent variable. Such a series of tests has been carried out by the Electrical Research Association in Report G/T288, by F. Oliver Mason.

The tests were carried out on an experimental unit, the current being kept at 1,000 amps and voltage at 6·6 kV r.m.s. values. Great care was taken that as far as possible each test was performed under identical conditions. Symmetry was controlled to within ±4°, and the open circuit voltage set accurately. After each test, top and bottom contact tips were renewed.

From previous experience it was expected that the variation in performance would, when plotted against pressure, approximate to a sigmoid curve, and it was also thought that 20-25 tests at each of say, 6 to 8 different values of reservoir pressure could be made in a reasonable time and yet determine such a curve with fair accuracy.

Of a total of 214 tests made, 199 were within the required standards. The tests were carried out at reservoir pressures of 85, 80, 75, 70, 65, 60, 55 and 50 lb/sq in., a "clearance" being a test in which the breaker cleared the circuit completely at the end of the first half cycle of arcing. Statistical analysis showed that the whole of the data could be considered as conforming to the normal integral curve with a mean of about 72 lb/sq in., and a standard deviation of 8·4 lb/sq in.

NEW BULK SUPPLY TARIFF

TWO changes are made in the bulk supply tariffs fixed by the B.E.A. for supplies to the area boards during the twelve months from 1st April, 1955. The coal cost adjustment charge is to be 0·0006d. instead of 0·00065d., and there is a new method of calculating chargeable maximum demand.

The change in maximum demand calculation is based on a notional aggregate maximum demand on the B.E.A. of 16,630 MW. The maximum demand on which an area board (or other direct consumer) will have to pay the stated charge of £4. 15s. per kW will be their maximum demand on the present definition multiplied by the ratio

$$\frac{16{,}630{,}000\ \text{kW}}{\text{Sum of maximum demands of all area boards.}}$$

The significance of this is, that during each year of account the fixed kilowatt charges in aggregate will correspond with the B.E.A.'s fixed costs of supply during the year, regardless of the effect of extreme weather conditions. Thus area boards will not be exposed to the heavy maximum demand charges they have met in the past when a short sharp spell of excessively bad weather has sent up maximum demand charges but has had a relatively small effect on units.

In any assessment of the choice of 16,630 MW as the estimated aggregated demand, it has to be remembered that from 1st April next, the B.E.A. will become the Central Electricity Authority, and will no longer include the Scottish Boards.

The basic unit price remains at 0·5d., based on a coal cost of 60s. and a gross calorific value of 11,000 B.Th.U./ton. The adjustment figure of 0·0006d. per unit applies for each penny/ton by which the fuel cost varies from 60s,

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Apprentices and National Service

I ALWAYS read your feature "Around the Trade" by "Peregrin" with interest, but I would like to express a very different view from that which he records in the last paragraph in your issue of 3rd February regarding deferment of apprentices. He states that "many employers, at inconvenience to themselves, urge apprentices to do their service at the normal age, deeming those two years less important and less expensive than those between 21 and 23".

I hold the view that it is far more important that an apprentice should complete his practical and theoretical training before he reaches the age of 21, and in some cases a further deferment is obtained by boys in our organisation to enable them to complete a course for the Higher National Certificate or for the Higher National Diploma after they are 21 years of age.

Having completed such training the lads can go in to the Forces with every chance of obtaining further work and experience in the electrical field of operation, whether this be concerned in the wiring or maintenance of army vehicles or aircraft. Finally, upon completion of National Service, the young man returns to industry a fully qualified electrician with considerable further experience in the armed forces to his credit and every opportunity of finding really useful work to do.

Under the alternative arrangement put forward by "Peregrin" wherein boys are called up at the age of 18, they return at the age of 20 having, as he says, forgotten half of what they previously learnt and having to start all over again, and much more subject to the attractions of other industries.

For these reasons boys are only apprenticed in our organisation upon the understanding that deferment will be applied for so that they can complete and make full use of the training which we give.

R. A. Marryat, B.SC., A.M.I.E.E.,
Marryat and Place Ltd.,
LONDON, E.C.1.

Promotional Tariffs

VARIANCE of opinion as to the extent to which load factor and sales per consumer are out of the control of boards was indicated in the extract from the discussion on Mr D. J. Bolton's paper, published in the ELECTRICAL TIMES of 10th February.

A major factor affecting both has, in the past, been the promotional tariff. Past successes in bringing down selling price and the present inflationary phase, which itself has a fortuitous promotional effect on units sold for residential and such uses, contracts but does not entirely eliminate the scope for future promotional injections. Going back to the time of the McGowan Report we find curves in that report showing with clarity, if indirectly, the great increase in consumption with lowering of tariffs. Of interest is that if the curves (*a*) relating consumption to average revenue, and (*b*) relating distribution costs to consumption are combined to give a curve relating distribution costs per unit to average revenue per unit, there emerges a line roughly expressed as A=0·62B—0·17d., where A is the distribution cost per unit and B the average revenue per unit, in pence. This drop in distribution costs with lowered tariffs explained of course the enthusiasm of some famous electricity systems for the promotional tariff and explained the resulting financial soundness of these systems.

Generation costs and bulk supply charges have a profound indirect effect upon distribution cost per unit too. To take the example of Norway, where residential load is an increasing proportion of total load, the fact that generation costs about a farthing per unit enables her to offer tariffs which result in the average distribution cost per unit coming down to a farthing per unit in the average selling price of a halfpenny per unit. Conversely, when the bulk supply charge goes up with its attendant adverse effect upon retail prices, it has a double effect in that it also puts a brake upon tendencies for distribution cost per unit to drop.

C. F. Matthews,
NEWBURY, BUCKS.

Architects and Electricity

IN your issue of the 10th February, your contributor Megohm deplores the fact that in spite of publications of the E.D.A., Codes of Practice, and Government publications, the majority of architects and planners are still not providing an adequate number of socket-outlets in dwellings.

While agreeing wholeheartedly with your contributor, I should like to draw his attention to the "Quicker Completion of House Interiors" published by H.M. Stationery Office, being a report of a Committee set up to report on what action can be taken to increase speed and efficiency in the construction of house interiors.

In paragraph 90 of this publication dealing with electrical work the following occurs: "Whatever system is adopted it is important that the number of light and power points should be kept to a minimum," while the Memorandum submitted by the Royal Institute of British Architects states (page 55) "15 amp outlets should be used throughout."

I regard as extremely unfortunate the fact, that these statements should be given official recognition and I hope that the E.D.A. and other bodies will continue to press for installations comprising an adequate number of points.

Incidentally I am very doubtful of the validity of the statement made in the R.I.B.A. Memorandum referred to above, that "The fixing of switches is tedious and the old type of tumbler switch was easier to fit being less complicated."

What, I wonder would be the reaction of the R.I.B.A. to a panel of electrical engineers set up to advise them on Architecture?

R. F. Kenchatt, A.M.I.E.E.,
SIDCUP, KENT.

Choosing a Motor

NOTES on selecting the "right" motor for any particular drive are given in B.T.H. Publication G11011 "The Choice of Electric Motors—characteristics of design related to the application." This booklet presents a concise survey of the subject and brings out the many factors that must be taken into account by an engineer before he arrives at his specification.

Copies of the booklet are available gratis to engineers writing on business notepaper to the Manager, Technical Publications Department, B.T.H., Rugby, mentioning the ELECTRICAL TIMES.

Britain's Nuclear Programme

1,500—2,000 MW IS TARGET FOR 1965

INTRODUCING the White Paper on a programme of nuclear power, Mr Geoffrey Lloyd, referred to the announcement as one of the most momentous ever to be made by a Minister of Fuel and Power.

The programme which is, mainly due to the rapidity of technical development, provisional, covers the period for the next ten years. Two principal types of reactor are likely to be brought in use on a commercial scale; the first, a gas-cooled improved version of the Calder Hall type, could be designed and built to come into operation by about 1961. The second of the liquid-cooled type might begin operation about 1965. After that date it is possible that "fast breeder" reactors might be developed—following on the experimental plant now being built at Dounreay—or a "homogeneous" reactor might be used.

The cost of Calder Hall will be about £15-20m, but improved reactors of the same type will produce more heat from each ton of fuel and thus involve a lower capital cost. After taking into consideration all the factors, the Government consider that enough uranium will be available for the civil programme over the next ten years. The cost of the initial uranium charge for an early type station similar to Calder Hall will be about £5m and a new charge would be necessary every 3-5 years. It is, however, expected that as much heat will be extracted from one ton of fuel as from 10,000 tons of coal.

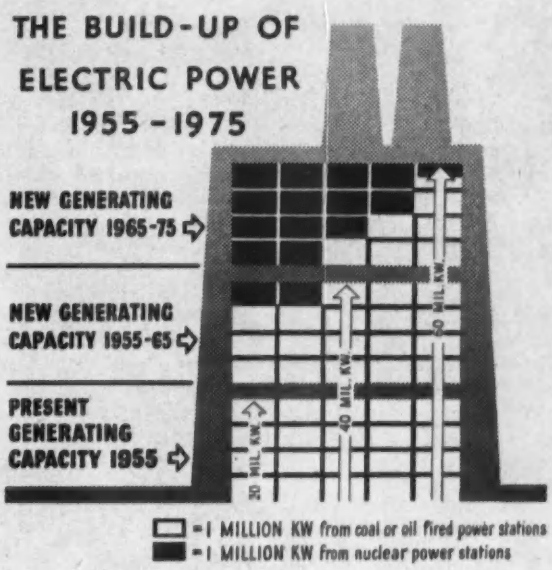
A by-product from the early reactors would be plutonium and the value of this would need to be assessed in relation to the costs as a whole. The first commercial nuclear station, taking all these factors into account should be able to produce electricity at a cost of about 0·6d. per unit. The value of plutonium would probably fall during the lifetime of later stations but even so their higher efficiency should enable them to remain competitive with other power stations.

The Programme

The stations will be built in the usual way by private industry but the Electricity Authorities will own and operate them. The Atomic Energy Authority, as the only body with the necessary experience will be responsible for giving technical advice on the nuclear plant. The work of training industrial and consulting personnel has already begun, but will call for great effort from all concerned. Even so, it will not be practicable to start building commercial nuclear power stations before 1957. The Atomic Energy Authority while giving as much assistance and advice to industry as possible will remain primarily a research and development organisation and will continue to design, build and operate pioneering types of power reactor. They will also be responsible for buying uranium, fabricating the fuel elements, and processing the used fuel.

The time-table provisionally laid down is for two gas-cooled stations, with two reactors each to begin building in mid 1957 and for operation in 1960-61. Two further gas-cooled stations of an improved type are scheduled for 1958-9 commencement, to be in operation by 1963. These also will have two reactors each. The total output from these stations should be 400 to 800 MW.

In 1960, it is proposed to start four stations—possibly gas-cooled but with one higher rated reactor each—operation to take place in 1963-4, and in 1961, four possibly liquid cooled stations, again with one higher-rated reactor each, for operation in 1965. These eight stations should have an installed capacity of well over 1,000 MW. Thus the ten-year programme should provide 1,500 to 2,000 MW of output. By the end of the ten years, the country would probably be needing new generating plant at a rate of over 2,000 MW per year, and the new nuclear stations would be providing about one-quarter of this. Assuming that the programme continued to expand the contribution to the country's energy needs should rise rapidly thereafter. Plutonium from the early reactors should become available in 1964 at the rate of several hundred kilogrammes per year and would be available for fuel enrichment in later reactors. These would in turn produce plutonium, and being higher rated should produce it more quickly so that it would be available for an expanding programme of reactors requiring enriched fuel in the late 1960's.


THE BUILD-UP OF
ELECTRIC POWER
1955 - 1975
NEW GENERATING CAPACITY 1965-75
NEW GENERATING CAPACITY 1955-65
PRESENT GENERATING CAPACITY 1955
20 MIL. KW
40 MIL. KW
20 MIL. KW
= 1 MILLION KW from coal or oil fired power stations
= 1 MILLION KW from nuclear power stations

Expenditure

Cost of the ten year programme might come to £300m, but investment over the ten year period would be higher as further projects would be started during that period. The B.E.A. investment over the same period would, in the absence of nuclear power, be £1,200m, and a significant reduction will take place in this. At the same time the N.C.B. capital expenditure would be reduced.

If all went well, it might be practicable by the early 1970's to expand the rate of construction of nuclear power stations to match the total requirements of new generating capacity. On this assumption the total nuclear capacity installed by 1975 would be of the order of 10,000 to 15,000 MW representing a saving equivalent to 40m tons of coal per annum.

No danger is foreseen in the commercial use of nuclear energy, nor should there be any major difficulty in the disposal of radio-active waste which will be small.

The TORONTO TROUBLE

Investigations into the Failure of two 100 MW Turbo-generators

IN the early days of April 1954, two major failures took place in the large Toronto steam station of the Hydro-Electric Power Commission of Ontario. In view of the magnitude of the disaster, intensive investigations were immediately started to identify and isolate the causes of the trouble, and the extent of these investigations together with the conclusions derived therefrom were detailed in a paper by Sir Claude Gibb and presented at the Institution of Mechanical Engineers.

Introducing the subject, the paper began by commenting on the problems involved in the design of end bells for large rotors. The fundamental problem lay in the selection of the material to be used. For mechanical strength, the designer would prefer to use a relatively low alloy steel which would provide the desired physical properties after hot forging and simple heat treatment. Considerations of magnetic paths, however, made it desirable to use a non-magnetic material to prevent excessive flux leakage and eddy current overheating. The material most widely used was, therefore, an austenitic steel, which while presenting advantages to the electrical designer, provided major problems to the metallurgist, the forge-master and the machinist. The major disadvantage of this type of steel was that the required physical properties could only be obtained by "cold" working, and not by heat treatment. As a result, residual stresses were set up which could not be controlled to close limits. Much work had been done and was being done to develop manufacturing processes which would obviate this.

Stators and rotors of No. 1 (above) and No. 2 (below) sets at Toronto showing damage at exciter end

The Toronto end bells, with an outside diameter of 58¾ in. and an inside diameter of 52¼ in. before machining, were forged under a 4,000 ton press by the following method. (1) The ingot was cogged into a billet in a number of heats, forging being carried out between 1,100° C and 900° C. (2) The billet was cut into blocks under the press. (3) The blocks were flattened (upset) and the central hole punched and drifted under the press, the shape being trued by flattening and edging. (4) Hot expanding was carried out on a mandrel in two stages. (5) The forgings were cooled and rough machined. (6) Expanding by forging under the press was carried out after heating to 1,050° C and allowing to cool to 480° C when forging began. (7) Stress relieving prior to machining was carried out by heating for 5 hours at 400° C and cooling in the furnace.

Item (5) in the above sequence was not carried out on the end bells for Nos. 1 and 2 generators, but was applied to those for Nos. 3 and 4 machines.

Another major problem for the designer was whether or not to drill ventilating holes in the end bells. Such holes were extremely useful in preventing excessive temperature rise in rotor end windings with consequent avoidance of copper distortion. The Toronto machines were to operate under most severe conditions and were likely to be varied in load from 10 to 100% of maximum rating, two or three times per day, and to be shut down each night. Such conditions were most conducive to coil distortion. It was, therefore, decided to provide ventilating holes, and, to avoid as far as possible stress concentrations, carefully sharpened drills were used and the holes radiused at the inside and outside surfaces of the bell.

The Accidents

No. 1 set first went on load on 28th October, 1951, and initially ran with a 2-pole rotor at 1,500 r.p.m. to provide a 25 c/s output. On 31st August, 1953, it was recommissioned with a new 4-pole rotor running at 1,800 r.p.m. and altered stator connections to give a 60 c/s output. It failed on 1st April, 1954. No. 2 set went on load on 4th February, 1952, and ran as a 60 c/s machine throughout. It failed on 5th April, 1954. At the time of failure No. 1 set had run 11,342 hours (6,915 on 25 c/s and 4,.427 on 60 c/s) while No. 2 set had completed 10,739 hours.

During the night of 31st March, No. 1 set had been shut down, and in the early hours of the morning of 1st April had been run up to speed in 22 minutes. Synchronisation took place at 5.55 a.m. and the load had been built up to 10 MW, when, at 6.14 a.m. an apparent explosion occurred. Flames immediately appeared at the exciter end of the generator, and developed into a major fire. It was at first thought that a hydrogen explosion had taken place, but subsequent investigation pointed to mechanical failure. The fire was fed by oil from fractured oil pipes and was

aggravated by the output from the auxiliary oil pump which cut in as the machine slowed down after being automatically tripped by the protection gear. About 3,000 gallons of oil were consumed.

After the fire had been controlled, supply was made available from Nos. 2 and 4 sets. On Monday, 5th April, at 10.58 a.m., when No. 2 set was generating 100 MW, a heavy thud was felt followed by excessive vibration and a similar sequence of events occurred as with No. 1. Again a heavy oil fire broke out although it was not so prolonged, the oil consumed being about 1,800 gallons, and again severe damage was done to auxiliaries, cables and switchgear. No. 4 set was then taken out of commission pending the results of investigations on Nos. 1 and 2.

Investigation

When the failure of No. 2 set took place, the examination of No. 1 set was already in hand, and it was found that the rotor end bell and about 75% of the teeth at the exciter end of the rotor had fractured. Both stator and rotor end windings had disintegrated and the stator frame was severely damaged. The bell was removed with great difficulty and it was found to have fractured in one place, radially and axially, through a line of three ventilating holes on a pole centre-line.

Examination of No. 2 set subsequently showed a similar fracture. A superficial examination of the fractures disclosed no flaws or abnormal feature, but indicated that a crack had started near the centre of a ventilation hole and had been propagated normally to the plane of the principle stress to the edge where the bell was shrunk on to the rotor body.

The rotors from both Nos. 1 and 2 sets were returned to England for examination and the end bell which failed on No. 1 unit flown back by charted plane for examination.

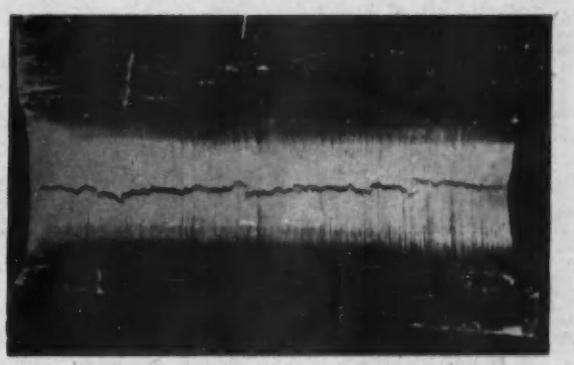
It had been known for some time that cracking of non-magnetic end bells could occur under long storage conditions, and investigations were already in hand as to the cause of this stress corrosion phenomenon. However, these cracks had been found to be transgranular while those in the end bells which failed both in service and in subsequent hydraulic tests were invariably intergranular. This possible cause was subsequently discarded. Another suggestion was that of severe single-phasing. Such a phenomenon had been known to give rise to severe overheating of slot wedges and arcing between the end bell and rotor body. No evidence could be found to support this view.

Hydraulic testing gear had been made and a series of tests were carried out on end bells from the Toronto sets and other generators (37 in. bells). With the exception of the end bell from Toronto No. 4 exciter end and one of the 37 in. units, all the failures under hydraulic test took place quietly without the crack spreading. The No. 4 end bell, however, failed with explosive force indicating a remarkably rapid rate of crack propagation and producing a fracture almost identical with the two service failures. Despite the fact that small capacity oil pumps provided the hydraulic pressure, the test equipment was damaged and it appeared that the gap at the fracture must have measured over 3 in. momentarily and then closed in again.

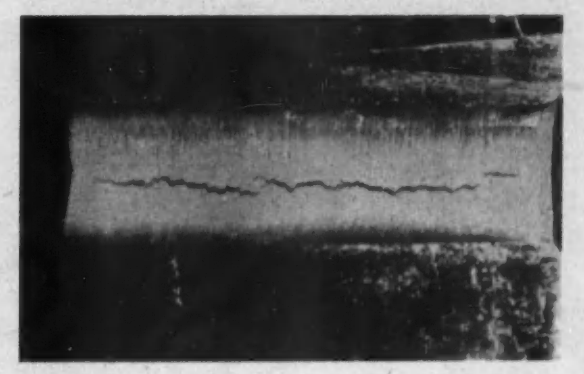
Intensive investigation of the work hardening within the ventilation holes and tests on non-drilled bells did not, however, yield much information on the cause of failure.

Fatigue

It was then that it was decided to put in hand repeated stress cycles by the hydraulic method to see what part fatigue played in failure. Previous failures on the Toronto end bells on the hydraulic test plant had occurred within



Sections of the turbine-end rotor-end-bell of No. 1 unit, Toronto, showing failures in ventilating holes after 76 repeated applications of hydrauli pressure of mean hoop stress of 27·6 tons per sq. inch



the hoop stress range of 35·7 to 41·6 tons/sq inch. Failure occurred on the cycle test at a mean hoop stress of 27·6 tons (Toronto No. 1 turbine end) after 76 cycles. Again the failure was similar to those in service. Subsequent tests on other bells confirmed the significance of the cyclic tests, and the general result was to show that failure could be brought about under a relatively small number of cycles of stress of about the same order of service magnitude.

Work began to find out how such cyclic changes could arise in service. The question of differential temperature gradients brought about by the impact of cold hydrogen on the bell while the rotor was still warm was considered and experiments carried out to check possible effects. The internal packing and end turn behaviour was investigated as also was the effect of residual stress. The holes, from the available evidence, were the starting point of the trouble due to the high residual stresses developed during machining which could not be relieved. It was concluded that the failures were not necessarily due to any single cause but probably due to a combination of variables, of which each was not in itself decisively significant.

The new rotors for Toronto were of the direct hydrogen cooled type and did not, therefore, need ventilating holes, and owing to the urgency of replacement, it had been decided immediately following the accident to use a well-known chrome-molybdenum alloy for the bells which would, however, be magnetic. A complete new 100 MW generator for No. 2 set was built and tested in less than seven months and should be running in the near future.

It was emphasised in the paper that changes in manufacturing technique of non-magnetic end bells had led to a reduction in residual stresses, and no hesitation would now be felt in fitting non-magnetic end bells to machines similar to those at Toronto, provided that direct cooling of the rotor was adopted with no ventilating holes.

Trends in European Supply

O.E.E.C. Forecasts Programmes of Member Countries up to 1958

TRENDS in European electricity supply undertakings up to 1958 are forecast in a study* by the Electricity Committee of the Organisation for European Economic Co-operation, published last week. Taking into account only plans which were firmly established in the middle of last year, it is estimated that the annual rate of increase of installed capacity will be only 5·2%, a considerable drop from recent years. Some increase in this figure may, however, be expected, as later supplementary schemes are introduced. It also seems probable that the proportion of total electricity generation attributable to private generation in industry will fall during the period under review.

The general survey of prospects for electricity supply in Europe is followed by a consideration of each member country of O.E.E.C. Most of the remainder of this article is concerned with this section of the study.

Germany. Electricity consumption has risen rapidly, and it is expected to reach $70{,}500 \times 10^6$ kWh in 1958, against $63{,}800 \times 10^6$ in 1954. Plans are in hand to supplement the internal 220 kV system with one of 380 kV. This network will also facilitate power exchange with neighbouring countries. Particular attention is being given to power stations burning lignite.

Austria. In 1954 about 850 MW of hydro plant and 120 MW of thermal were under construction. This is expected to cover requirements up to 1958. A feature of new construction is co-operation with the German Federal Republic in building jointly operated power stations on the rivers Inn and Danube. Power exchange with other countries is expected to increase.

Belgium. Output is expected to rise more rapidly in coming years, reaching $13{,}500 \times 10^6$ kWh in 1958, with 3,300 MW installed capacity. Much of industry generates its own electricity. Use of low grade coals and petroleum refinery residues is expected to increase.

Denmark. The programme for agricultural development in Denmark allows for extremely rapid electrification in the next few years. During the 1952-58 period, about 60% of investment is allocated to network extension. By 1958 it is expected that 95% of home generation will depend on imported fuel.

France. Financing difficulties have delayed the second stage of the electrical modernisation and extension plan, but in spite of this it is expected that the rate of increase in the period 1954–58 will be 7·1%. Installed capacity should be 15,600 MW by 1958, and an appreciable improvement in load factor is expected. By 1958, thermal plant output is expected to have passed that of hydro plant.

Greece. Plans exist for extending the installed capacity from 353 MW (1953) up to 573 MW by 1958. This should make possible an increase in the electricity consumption per head of population, which at present is at the low level of 138 kWh. Outstanding feature of the new plan is a new 150 kV grid linking important centres throughout the country. It is feared that financing difficulties may slow down the programme from next year.

Ireland. Installed capacity is planned to increase at a rate of 14% per year over the period 1953–58. New plant will be mainly thermal, and by 1958, 69% of output will come from thermal stations; there will be a slight increase in the proportions of fuel oil used. The major part of the increased power will go for domestic and agricultural applications.

Iceland. By 1958, all communities should be supplied with electricity. So far, only 2½% of the country's hydro potential has been tapped. If the ten principal rivers were fully used for electricity generation, they could give an output equal to the present hydro output of France. At present, however, it is not certain that this could be absorbed.

Italy. Natural gas is expected to play an increasingly important part in electricity generation in Italy. It is considered that difficulties about financing the expansion of electricity supply in Italy can only be overcome by the investment of foreign capital on a large scale.

Luxembourg. Most electricity generation in Luxembourg is by industrial firms, for their own use. 1958 estimates show 15 MW of public utility plant against 234 MW of industrial. In spite of this, domestic electrification is expected to develop rapidly, while electrification of the Luxembourg State Railways will also have a marked effect.

Norway. Although Norway already has the highest electricity consumption per head of population in the world, expansion is expected to continue rapidly, with the particular object of easing the peak situation. At present several separate networks supply the country, and it is planned to link up most of them by transmission lines so that eventually from 80 to 85% of the total population will be served from one common network. It is noteworthy that in most districts, the consumption of electricity is restricted in some way.

The Netherlands. Expansion of electricity generation is being planned on a short-term basis. While proportionately more electricity is expected to be used industrially, the use of electricity in the home for cooking, water heating and space heating is expected to increase considerably.

Portugal. A rate of increase in electricity output of 10·5% per year is planned. At present, consumption per head of population per year is only about 200 kWh. Much of the expansion is in hydro plant, which should reach 754 MW of installed capacity by 1958 compared with 143 MW in 1948. Development of distribution networks is effecting a particularly marked rise in domestic use of electricity.

Sweden. Amongst developments in the overwhelmingly hydro-based supply industry of this country is the building of a 350 MW thermal station, equipped to burn either coal or fuel oil. The 380 kV transmission network is being expanded considerably.

Switzerland. In spite of high existing consumption, domestic demand is continuing to expand rapidly. Export of electrical energy is at present limited by the high internal demand, but it is anticipated that by 1958, 13% of the total output will be exported. In 1961–62, total output should be $18{,}000 \times 10^6$ kWh per year, and in 1980, when all practicable hydro resources are expected to be harnessed, $28{,}000 \times 10^6$ kWh is hoped for.

Turkey. Since 1950 considerable expansion has taken place in Turkey, with a notable increase in the average size of power station. By 1958 there should be 1,700 MW of thermal capacity and 1,685 MW of hydro. Hydro-electric generation is extensively associated with the building of dams for irrigation purposes.

* *"The Electricity Supply Industry in Europe," published by H.M.S.O. for O.E.E.C., price 10s.*

NEW SUBSTATION FOR THE CITY

Lord Mayor opens L.E.B. Seacoal Lane premises

JUST to the north of Ludgate Circus, and running up from Farringdon Road to join Fleet Lane just before it runs into Old Bailey is a street called Seacoal Lane. The site to the south of this lane is now occupied by a new modern building, Seacoal House, occupied entirely by the London Electricity Board and containing one of the more important substations feeding not only part of the existing City of London, but also destined to provide power for much of the rebuilding programme.

The site itself was particularly difficult in that it lies on a fairly steep gradient, and the building to be erected on it had to conform architecturally with the general rebuilding plan of this part of the City. These restrictions posed some particularly difficult problems on the architects who had to design a structure which could contain within it a 60 MW substation complete with the necessary control room, switchgear and auxiliary services. It was originally intended to utilise the office accommodation in the building for letting out as revenue earning premises, but in view of the importance of having a modern and efficient administrative headquarters in this section of the City the original plans were modified with the result that the whole building is now occupied by the London Electricity Board, who are providing facilities for accounting. The substation takes its infeed from the 22 kV system of the L.E.B.

Control of the 22 kV side is exercised by 19-panel A2T Reyrolle switchgear with a rupturing capacity of 500 MVA, and feeder ratings of 400 amps. The busbar system is rated at 800/1,200 amps. From this 22 kV system, three English Electric (ultimately four) transformers feed the 11 kV section, which distributes to local substations. The transformers are each rated at 15 MVA, are naturally cooled, have on-load tap changing gear, and are located in en-

Top of the page: The Lord Mayor makes the switch watched by the Chairman and Deputy-Chairman of the London Electricity Board

Top to Bottom right: The Control Board, 11 kV metalclad switchgear, 22 kV metalclad switchgear and the heating installation

closures at ground level. Protection on the 22 kV side is residual balance with earth leakage check for the busbar zone, Beard-Hunter for the feeders and overcurrent, restricted earth leakage and Buchholz for the transformers.

The 11 kV switchgear also made by Reyrolle is type C6T and C7T and consists of 22 units with a rupturing capacity of 250 MVA, a busbar rating of 1,200 amps and a feeder rating of 400 amps. Protection on this side is Solkor, overcurrent and earth leakage for the feeders. Statistical metering is included on the l.v. side of the transformers. This 11 kV system feeds the City area, local substations being incorporated in the buildings or located elsewhere.

An interesting feature of the building is that it is heated throughout from the first to sixth floor level by electrothermal storage equipment. The contractors for this plant were Rosser and Russell Ltd., and the boiler, which is automatically controlled by regulating shields reducing the electrode current, was manufactured by G.W.B. Electric Furnaces Ltd. Space temperatures, based on an external temperature of 30° F, are 65° F for the offices.

The boiler has a maximum capacity of 450 kW, 415 V, 3-phase. Two storage vessels are provided with an individual capacity of 3,000 gallons each. The storage temperature under 95 ft head is 250° F, and the flow temperature is 110° F average rising to a maximum of 125° F. The off-peak control is by time switch and two off periods, 9 a.m. to 1 p.m. and 2.30 p.m. to 5.30 p.m. are provided.

The switchgear, in the basement, is comprehensively protected against fire by a CO_2 installation provided by the Pyrene Co. Twenty-three 80-lb cylinders are on automatic control with a secondary installation of the same size for manual reserve.

Speaking at the official opening of this new substation and administration building Mr H. J. Randall, Chairman of the London Electricity Board, referred to the long history of Seacoal Lane which had been mentioned in writing as far back as 1228. He also remarked on the history of electricity supply in London which had in the early days some 40 to 50 local authorities each supplying electricity on a local basis and each with a different tariff structure.

In the City of London, electricity consumption was rapidly increasing. In 1955 it was expected that sales would be about 70% higher than in 1947. Long before the rebuilding plans for the City had been seen, the London Electricity Board had taken steps to ensure that supply was ready and available when it would be needed.

The Lord Mayor of London, Sir Seymour Howard, who performed the actual opening ceremony by closing a switch on a mimic diagram, referred to the occasion as another date in the progress of lighting and heating in the City. He was indebted to the L.E.B. for preparing their plans so early in the rebuilding programme.

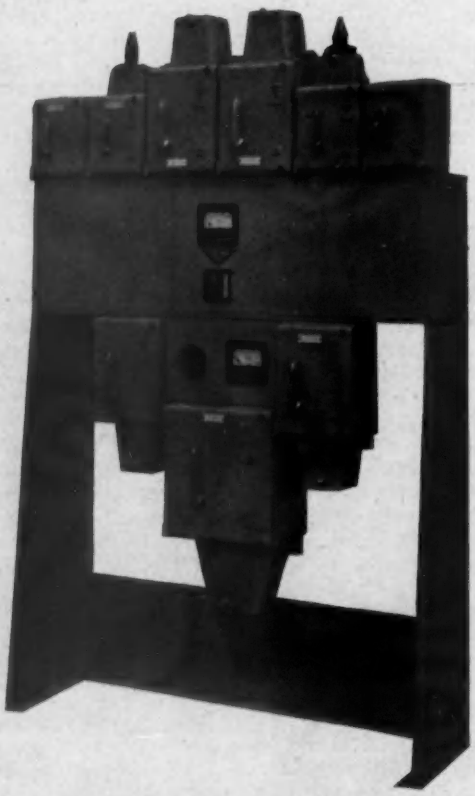
Mr D. B. Irving, the deputy-chairman, proposed a vote of thanks to the Lord Mayor.

Switchboard Design Speeds Erection

DURING a demonstration staged last week, Dorman and Smith Ltd. showed that by employing their new method of switchboard construction, much time could be saved. In less than an hour two fitters erected a small composite board which consisted of a pedestal mounted busbar chamber having an incoming 300 A fused switch unit below and 3 smaller outgoing units above. This time-saving method relies on the use of standardised components which can be mounted in a variety of ways to form any desired arrangement. Three standard busbar chambers are available having lengths of 30, 39 and 48 in. and each houses busbars which have a maximum rating of 300 A and are arranged for triple pole and neutral operation. No earth bar is provided.

Five sizes of fused switches ranging from 30 A to 300 A at 500 V are manufactured and all have been A.S.T.A. tested to 35 MVA rupturing capacity at 440 V. A feature of these units is that they are operated from the front which permits their being mounted adjacent to each other, with consequent saving of space and reduction of costs. Up to 100 A they are arranged for conduit entry whereas above this figure a cable sealing box is provided. Connection to the busbars is by P.V.C. cables for all but the 300 A incoming unit, where copper risers are used, but these are not supplied.

Speed of erection is ensured by using special clamping plates for fixing the fused switches to busbar chamber and easy fixing cable clamps for securing cables to busbars. For each size of fused switch there is a particular adaptor plate which determines conductor spacing. Meter chambers may be provided, if required, and all components are available separately so that the customer may carry out his own extensions. To ensure rigidity, back plates and couplers are fitted to the bases of the pedestals.



Just over 3 hours was taken to erect this "Dorman" switchboard

From an engineer's notebook

TO the layman science has an essential unity which is far from manifest in a collegiate hierarchy of "bugs" and "stinks" and surprisingly even "pure." Perhaps the layman is right after all, for despite ever increasing specialisation, there appears to be a greater interplay between the many subjects which make up the rounded whole of science. One of the branches of science that has been most exclusive in its outlook, is entomology, yet recently I came across two examples of the latest techniques of physical science in use in this field. The first was the use of radioactive phosphorus as a tracer for the study of the feeding habits of mealy bugs, those insects which are doing so much to restrict the world's supply of chocolate. The phosphorus is injected into the tree and disperses through the sap with the consequence that any bug daring to drink of such nectar is for ever branded in the eyes of a geiger counter. Unfortunately, the first results have not been wholly satisfactory owing to the uneven dispersion of the tracer through the tree but no doubt in time a technique will be achieved that will result in the tree behaving as placidly as a patient taking a barium meal at a doctor's behest.

The second example is also a sign of man's determination to rid the tropics of pests which restrict its fruitfulness; this time it is the age old problem of locusts. Although remedial measures are available with the use of aircraft, the advance detection of the swarms is essential and to this end the use of radar is being tried. The idea arose from the possibility of detecting rain drops by this means (since the locust is more than half water) the echo being proportional to the product of the number of droplets and the sixth power of their diameters. With densities of 0·1 locust per cubic metre, echoes comparable with those given by heavy rain could be expected. The first swarm to be detected by radar was in March last year and the information obtained shows that this technique opens up new possibilities of obtaining data necessary in this ever intensifying tropical war.

* * *

I HAVE written before of the attempts being made to produce a portable electric source powered by nuclear energy. The beta emitter has been the main approach so far but it is still limited to the smallest capacities, but none the less offers the most likely promise for higher powers. An alternative device using the heat available from radioactive isotopes has been developed which offers promise for applications requiring small sources of electricity. Polonium is used as a radioactive source in this case on account of the high alpha particle content of its emanations; its half-life is 138 days. The surface of the polonium is held in contact with the hot junction of some forty thermocouples, the whole being surrounded with a silica aerogel to provide adequate thermal insulation to maintain a temperature difference of 450° F. Unfortunately no particulars of the cell's capacity have been given, beyond a general statement that it is of the same order as an ordinary dry cell. Quite clearly such a device is at present unlikely to be commercially competitive with the dry Leclanché type but it is one more step towards the time when we shall be all-nucleonic.

* * *

ALTHOUGH electro-polishing is quite an old technique, I must confess I have never seen the process used outside the limited confines of a metallurgical laboratory where one is more interested in the crystal structure than the methods by which it is shown up. Consequently it came as something of a surprise to me to learn of the extreme smoothness of surface that can be obtained with this inverted form of electro-plating. So intense is the anodic activity centred on any high spots on the surface being treated, that a smoothness has been achieved with a variation of as little as 2×10^{-8} in. in surface level. Admittedly this was something of a special effort, as the particular surface was required for a study of the absorption of incident light by outer orbital electrons of a metal. As this light penetrates no more than a depth of some 8×10^{-8} in. the need for such a surface was obvious. The target was maintained in a high vacuum at 4° K and Monochromatic light focused on it. The reflected light was directed on to a surface of gold black where the high degree of absorption by the colloidal gold particles prevented any chance of secondary illumination. The absorption of light energy by the target itself was ascertained directly by the measurement of temperature rise using minute resistance thermometers. This like so many other scientific experiments, is simple in concept but success can come only through care and refinement at every stage of the work.

* * *

NOVEL forms of construction always have an appeal for me, that is why I should love to turn over in my mind the idea of an electric motor or transformer wound with printed circuits. I have read of such constructions, but have never yet seen one and although I should want a deal of convincing of their ability to stand up to the rough and tumble of industrial use, the idea has a fascination all its own. I fear we must leave to radio engineers the attraction of this method and to them also a new idea in constructing audio frequency transformers which again has the merit of delightful simplicity. Essentially it is no more than the rolling of sheets of aluminium foil and cutting them into wafer coils. The obvious difficulty of connection is at least partially overcome by attaching the foil to a metal tube round which it is wound. The foil is insulated or interleaved with paper but I should have thought this design was a suitable case for the use of those new resins with which small components are "potted" in solid plastic. The merit of the method lies not only in its simplicity but in the compactness of the coils, with conductor dimensions in the range of ten-thousandths of an inch which can be varied upwards by the use of thicker foil and thicker sections. Performance is said to equal a.f. transformers of normal construction.—*E. R. G.*

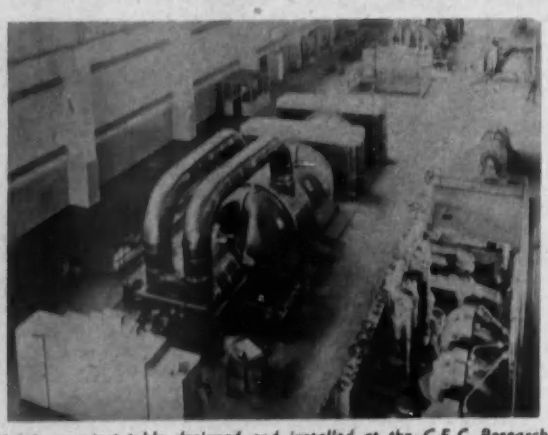
Electrical Progress in 1954

TECHNICAL INTEREST IN THE OUTPUT OF A LEADING ELECTRICAL MANUFACTURER

ALL manufacturers of large turbo-alternators are actively investigating designs for sets in the 100 MW and upward range and G.E.C. are no exception to this, having developed designs suitable for the higher proposed standard conditions of 200 MW, 2,350 lb/sq in. 1,050° F with reheat to 1,000° F; and 120 MW, 1,500 lb/sq in., 1,000° F with reheat again to 1,000° F. Both these types of machines are three-cylinder, tandem arrangements and run at 3,000 r.p.m. Many of the more standard machines were produced and commissioned during the year.

Transformers continued in demand, and orders were placed by the B.E.A. for three 72 MVA generator transformers for Hams Hall "C," and construction is proceeding on the first of four 120 MVA, 275/132 kV autotransformers for the Supergrid.

An unusual item being built is a rectifier transformer, hermetically sealed and filled with Pyrochlor, which is designed for printing press drives for the *Montreal Star*. Another interesting group which has been built for test purposes consists of three single-phase transformers capable of providing 44,000 amps at 90 V on an intermittent duty cycle. New test equipment installed in the transformer works includes two 10,000 kVA water-cooled alternators each driven by a 2,450 h.p. synchronous motor at 1,000 r.p.m. These sets are designed to run in parallel with the existing test plant and with the 4,000 kVA machine in the substation of the heavy engineering works.



At top, new test table designed and installed at the G.E.C. Research Laboratories for the measurement of the parameters of valves during life test. Immediately above, the turbine room at Uskmouth power station with 60 MW G.E.C. sets

Rectifiers and Winders

Further improvements in the design of both multi- and single-anode grid-controlled rectifiers have eventuated as operational experience has been forthcoming. Further gear on order for Netherlands Railways brings the total capacity of rectifier plant for this system up to 46,000 kW. Other orders cover requirements for New Zealand, Australia, India and Portugal. Forty-nine 2,500 kW equipments are being supplied for the frequency conversion scheme of the Southern Region of British Railways, and other orders are for steelworks, paper makers and printers.

The modernisation and expansion programme of the National Coal Board has kept the works busy on the production of winding plant for home use. The first large Koepe winder put into operation was at Bradford Colliery (Manchester) and is designed to raise coal from three levels—2,802 ft, 3,312 ft, and ultimately 3,822 ft. Both at home and overseas, the trend is toward tower mounted multi-rope Koepe winders, and automatic winders, and much work is being done in this field. The N.C.B., for example, has placed an order for two 4-rope Koepe winders for the redevelopment at New Monckton Colliery in the Carlton area of the N.E. Division.

Rolling Mills

Development and modernisation of rolling mills continues apace. Richard Thomas and Baldwins have placed a contract for the conversion of the 3-stand strip mill to a 4-stand mill at the Ebbw Vale Works. The immediate output speed will be 1,500 ft/minute rising to 2,000 ft/minute when the first two stands are modernised. Two 3,000/4,000 h.p. twin-armature motors

will drive stands 3 and 4 and a 750/1,000 h.p. twin-armature machine the reel drive. A 9,000 h.p. 6 machine motor-generator set, all associated a.c. and d.c. switchgear, control board and mill control cabinets are included. A large amount of equipment is also being supplied to the Cleveland works of Dorman Long and Co. Here the orders include all the control gear for a medium section mill for rolling a complete range of medium size structural sections. Three rectifiers with grid-control supply the feed to the 1,500 h.p. motors driving the three stands, and arrangements have been made whereby any two rectifiers can be connected in emergency to feed all three mill motors. In addition over 100 a.c mill motors totalling over 7,600 h.p. are on order.

All the electrical equipment for the multiple train units of the Manchester-Glossop line, officially opened last June, and which has shown an increase of over 100% in passenger receipts since that date, was supplied by the G.E.C., and a contract for similar equipment comes from the Eastern Region of British Railways in connection with the electrification of the line between Shenfield and Southend (Essex). This extension of the London (Liverpool St) electrification requires an initial order of motors and control gear for thirty-two 4-coach trains.

Manufacture of electrical equipment for fifteen diesel-electric shunting locomotives is in an advanced stage and erection of the locomotives has now begun.

Electronic Control

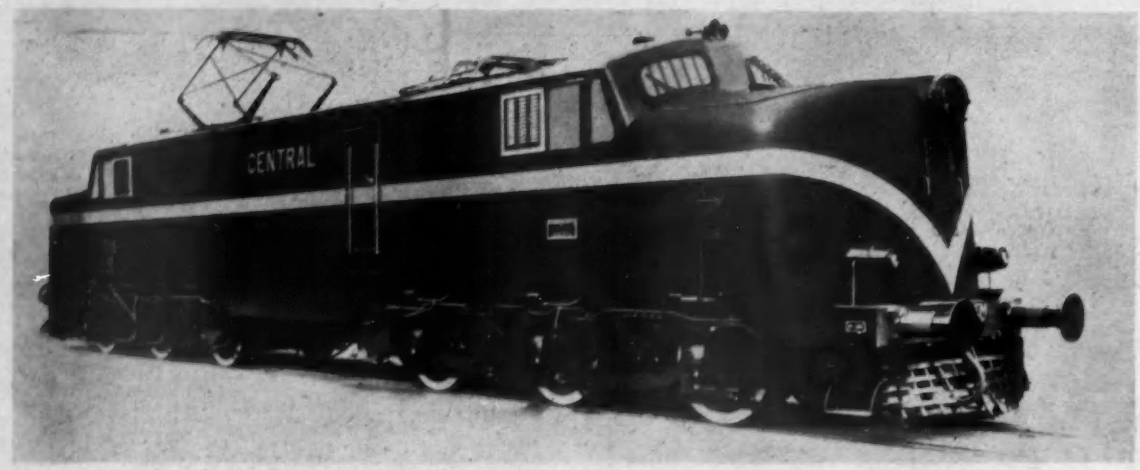
A simple type of current limit control has been developed for use with a variable speed d.c. motor, the speed of which is controlled by varying the voltage applied to the armature by a grid-controlled rectifier. Should there be a disturbance in the a.c. line, the motor may slow down appreciably and then draw a heavy current when accelerating again during the recovery of voltage. By this system, a transductor produces a signal proportional to the d.c. motor armature current which has the effect of retarding the phase of the voltage applied to the grids of the rectifier.

Electronically controlled welding is exemplified by the development of a steam welder for the jointing of very thin metal sheets at a speed of 2 ft/minute. It will handle steel sheets, 10 mils thick, Inconel or nickel 6 mils thick and stainless steel, brass or copper, 3 mils thick. The machine is already in use at Armstrong Siddeley Motors Ltd., for joining stainless steel sheets, 0·004 in. thick for covering the heat insulation material used on the combustion chambers of the new Sapphire jet engine.

In the valve field, three new experimental magnetrons with somewhat unconventional design features have been produced. The E. 1936, is a low power tunable valve operating in the 3,000 mc/s band and by employing the interdigital type of anode, allows an external resonant circuit to be used. The E. 2524 magnetron is a low power tunable valve for working in the 10,000 mc/s frequency range. It is a simple form of valve with a small glass envelope through which power couples directly to the load circuit. The principle of space component operation is used which allows oscillation with useful power output with only two internal resonant circuits. Another new valve is a cold cathode type which has been developed for electronic switching.

In the lighting field, a new series of Osram filament lamps operating at a controlled initial colour temperature of 3,250° K has been introduced. These lamps are for use with colour film balanced for 3,200° K and cover the range from 10 kW—in a bipost studio lamp, to the popular 275 and 500 W photofloods. For photographic enlargers, the range from 40 to 100 W may be provided with internal silica loading.

These G.E.C. pictures show; top, machining tee slots in a large rotor forging; centre, Koepe winder as installed at Bradford Colliery Manchester, and bottom, one of fifteen 6,667 kVA forced-cooled transformers for Toronto



Electric Locomotives for India

3,600 h.p. Units for the Bombay-Poona Line

THE first of seven 3,600 h.p. electric locomotives ordered by Indian Railways from the English Electric Co. has now arrived in Bombay. These locomotives are destined for use on the Bombay-Poona (119 miles) and Bombay-Igatpuri (84 miles) routes. Both tracks include long stretches of 1 in 40 gradient, combined with sharp curves, the Poona line having at one part some 15 miles continuously rising at this inclination. The introduction of these large and powerful locomotives will enable freight and passenger trains to be worked at speeds considerably higher than has been previously possible.

Main Electrical Arrangement

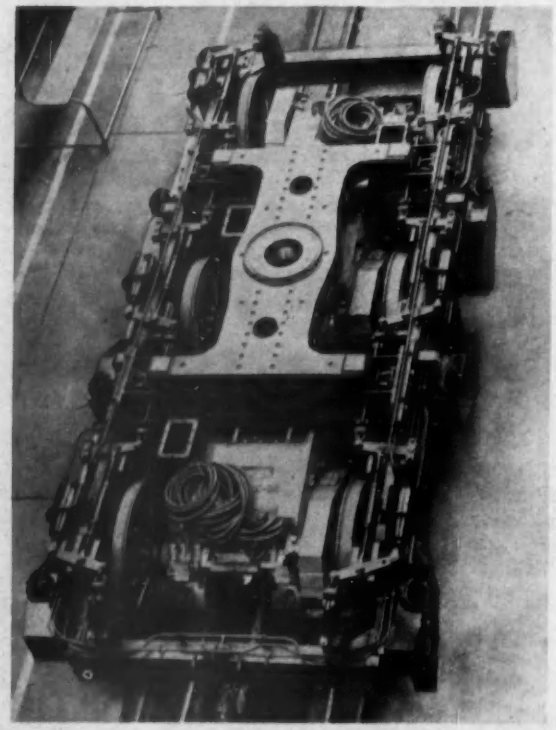
Most of the control equipment is housed in two compartments containing four frames transversely across the locomotive, while the main starting resistance is split into two sections mounted longitudinally on both sides of the locomotive. Behind the cab at one end is a compartment housing a motor-generator set, and behind the cab at the other end of the locomotive are two air compressors.

The motor generator set is built up of three machines having a common armature shaft. The 1,400 V d.c. motor drives two generators, one of which provides the excitation for the traction motors during regenerative braking, the other supplying 110 V for battery charging, and in conjunction with the battery, a regulated voltage of 110 for the control-gear, lighting and the ventilating fan motors. All the other engine auxiliaries are powered by motors operating at line voltage, and they include the traction motor blowers, the two motor driven reciprocating exhausters, and two motor driven reciprocating compressors for locomotive brakes, control gear, sanding and horns.

In each driving compartment is the master controller, brake valves and auxiliary switches. The master controller has a handwheel and three levers, the wheel being used for power notching and the levers for reversing and field weakening, regenerative notching, and selection of motor grouping for regenerating. The handwheel and levers are mechanically locked to prevent incorrect operation.

There are nine running notches after the starting resistance has been cut out. These correspond to: all six motors in series; two parallel circuits of three motors in series, and three parallel circuits of two motors in series. In each of these combinations the motors may be run on full, intermediate or weak field. For regenerative braking, fourteen notches are provided, available in the various motor groupings.

Principal dimensions of the locomotive are 68 ft 4½ in. long, 10 ft 6 in. wide and 14 ft 1 in. high. Its weight is 123 tons and track gauge 5 ft 6 in. With 4 ft dia. wheels, the maximum operating speed is 75 m.p.h. and the tractive effort (25% adhesion) is a maximum of 69,000 lb.



One of the bogies with waterproof motors for working under flooded track conditions

INDUSTRIAL MAINTENANCE

Protective Gear Discrimination in Factory Distribution Systems

by H. Saunders, B.Sc.(Eng.), A.M.I.E.E., A.M.I.Mech.E.

ANY large factory electric power distribution network employs protective gear of a variety of makes and types. Most protective devices possess a time delay feature, the time lag between the application of the operating current and the interruption of the supply being an inverse function of current. The protective gear should, as far as possible, be selected, positioned and adjusted in such a way that correct discrimination is achieved; i.e. that in the event of a fault on any part of the system, the faulty apparatus or installation only is tripped out, without shutting down any healthy sections of the plant. Different makes, types and designs of gear have current-time characteristics of different shapes, and, particularly where two or more different voltages are concerned, the direct verification of correct discrimination under all overload or fault conditions from the makers' curves is laborious, involving extensive calculations and graphical work.

A method of standardising and systematising the characteristics concerned has therefore been evolved, with a view to simplifying the problem of discrimination, its functions being:

(*a*) To facilitate the checking of existing protective gear adjustments.

(*b*) To facilitate the selection and adjustment of protective gear on new installations.

(*c*) To form a comprehensive record of protective devices and their settings.

The characteristics are each drawn on a separate sheet of paper and reproduced on photographic film. A double logarithmic scale is used and this article describes the advantages to be gained from this method.

For the purpose of this article, protective gear in a factory electric power distribution system may be classified into:

(*a*) Instantaneous devices, and

(*b*) Devices which operate only after the expiry of a time delay during which the operating current is sustained.

Time lag devices are introduced for one or both of the following reasons:

(*a*) To avoid unnecessary operation under fault or overcurrent conditions of such short duration as not to be detrimental to the installation protected.

(*b*) To permit discriminative protection.

This article is concerned with the latter aspect of time lags. A protective system is said to possess discrimination if it is so arranged that in the event of fault or overcurrent the faulty apparatus or installation only is tripped out, without shutting down any healthy sections of the plant.

Whilst a great variety of protective gear, working on a number of different principles, is available, the straight forward "time lag as an inverse function of current" has the widest application in industrial installations, as being the most economical system for this particular purpose.

The devices may conveniently be classified according to the method of obtaining the delay, into:

1. *Induction Type Relays.*—The time is given by the distance travelled by a contact mounted on the periphery of a circular disc divided by the peripheral speed, the latter being a function of current.

2. *Time Lag Fuses.*—The fusing time is an inverse function of current.

3. *Dashpots.*—This method, generally associated with solenoids (magnetic overload trips) relies on the time taken for a piston to travel through a given distance in a cylinder containing a viscous liquid. The force applied to the piston (which is connected to the solenoid plunger)—and therefore the speed—is a function of current.

4. *Thermal Devices.*—The distortion of a bi-metallic strip with temperature is utilised, the device being either mounted on the apparatus in such a way as to obtain its heat directly from it, or provided with a heater element the current through which is proportional to the current flowing through the appli-

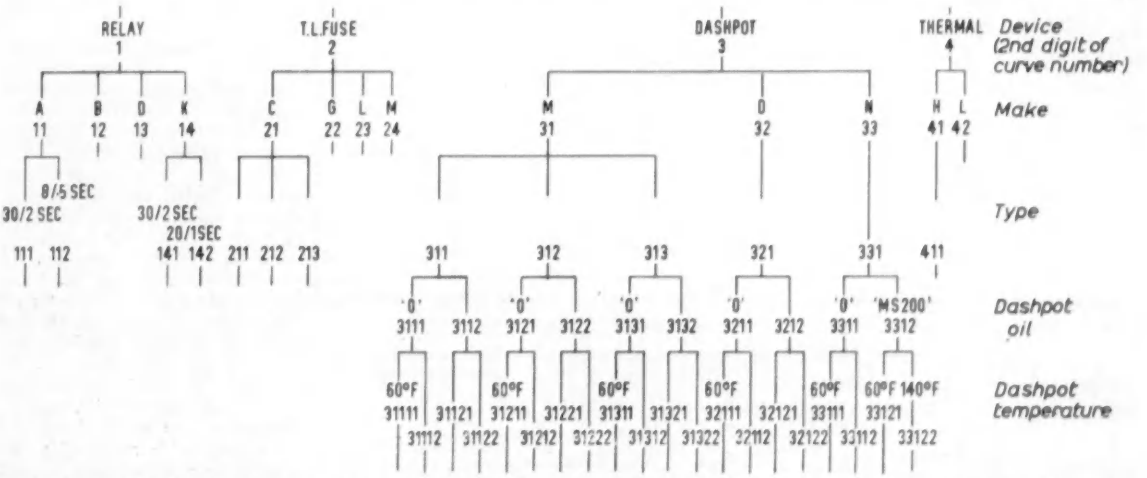


Fig. 1. Decimal classification of characteristic curves of protective devices. The first digit—not shown in the chart—denotes voltage (1 for 11 kV, 2 for 3·3 kV, 3 for 400 V.). Type descriptions, not entered in this chart, are those adopted by particular manufacturers

ance. In either case the speed of distortion is a direct function of current.

The data required for the evaluation of operating time at any particular current are generally given in the form of a time-current characteristic, sometimes, as in the case of h.r.c. fuses as a family of curves (each curve representing one particular type and rating) and sometimes as one master curve whose values have to be multiplied by a number of factors to take account of settings and other variables. Different manufacturers have different methods of presenting their information and the data are further obscured in cases where discrimination between h.t. and l.t. gear has to be investigated. The problem can therefore not be satisfactorily tackled on a factory scale without first "knocking into shape" the information supplied by the manufacturers and creating a system in which all characteristics are clearly related to each other without the need for tedious slide-rule calculations, or the necessity of drawing out a separate set of curves for every circuit investigated.

Arranging Information

This requirement of arranging information for convenience in handling can be satisfied in a variety of ways. The system finally adopted as possessing the most desirable features for an extensive distribution network consists basically of a "library" of the characteristic curves of all the different devices in use (and, where adjustable, the different settings), each one drawn on a separate sheet of paper and reproduced on transparent material; all curves are drawn to the same scale, and referred to the same voltage, so that any combination of curves may be studied in relation to each other, by superimposing the curves selected. For greater clarity, no grid is provided on the curves themselves, a separate transparent grid sheet being superimposed when required.

Each curve is given a number, the decimal classification being employed (Fig. 1) and, in conjunction with two specially prepared schematic drawings of the substations,—one for overcurrent and the other for earth leakage devices —showing the appropriate curve numbers on each switch, a convenient record of devices and their settings is obtained. The curve numbers and settings are cross-referenced by completing the schedule shown in Fig. 2, which is displayed on the wrapper of each curve, together with the appropriate schedule of data shown in Figs. 3, 4 and 5. Rubber stamps are used for schedules relating to devices on which large numbers of different ratings or settings are used.

The selection of a suitable scale to cover the entire range of currents from the smallest h.r.c. fuse at 400 V to relays with, say, 300/5 c.t.'s at 11 kV requires care, particularly in view of the comparatively high cost of the transparent film used, and a suitable compromise has to be made between accuracy and cost. A logarithmic scale is used for both the current and time scale, and in this way it is possible e.g. to cover a range of ·05-60 seconds and 1-4,000 amps at 11 kV (40-100,000 amps at 400 V) on an area measuring approximately 11 in. x 9½ in. using 3 in./cycle graph paper, with an accuracy at least equal to (and in some cases even greater than) that of the device itself. The overall sizes of sheets are shown in Figs. 6 and 7. This arrangement makes the best use of the standard sizes of the transparent film and avoids, as far as possible, the superimposition of schedules of particulars when several curves are viewed simultaneously. Thus spaces 1 to 10 on Figs. 6 and 7 have been allocated for schedules of data as shown below:

1. Protective Gear on h.t. ring main switches.
2. Protective Gear on h.t. spur switches.
3. Protective Gear on h.t. transformer switches.
4. Protective Gear on l.t. incoming switches.
5. Protective Gear on l.t. feeder switches.
6. Protective Gear on l.t. motor starters.
7. Fuses (other than t.l. fuses on switches) 15-30 amp rating.
8. Fuses (other than t.l. fuses on switches) 40-75 amp rating.
9. Fuses (other than t.l. fuses on switches) 80-160 amp rating.
10. Fuses (other than t.l. fuses on switches) 172-350 amp rating.

Fig. 8 shows a typical curve sheet for the protective device on an h.t. transformer switch and Fig. 9 shows a typical fuse characteristic sheet. A typical arrangement, showing a ring main switch, spur, h.t. transformer switch, l.t. incoming switch, l.t. feeder switch and two h.r.c. fuses is shown in Fig. 10.

In addition to the useful feature of enabling a very wide range of values to be shown on a comparatively small area, the logarithmic scale possesses the further advantage that multiplying or

CURVE No.....

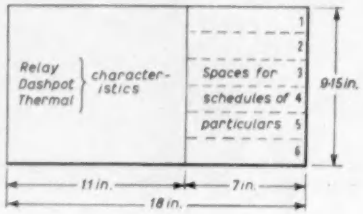
SUB-STATION	FEEDER

FUSE GOOD	MAKE		TYPE	
	H.R.C. OR Re-wirable		MATERIAL	
	RATING		SUPPLIER'S CATALOGUE No.	

RELAY		C/T RATIO	PLUG SETTING MULTIPLIER %	RELAY BECOMES OPERATIVE AT	OPERATING TIME BECOMES CONSTANT AT	TIME SETTING		
MAKE	TYPE			..... AMPS	..... AMPS	DELAY AT ..... AMPS (SECONDS)	DELAY AT AND OVER ..... AMPS (SECONDS)	MULTIPLIER (M-V ONLY)

Make	Rating	DASHPOT				MINIMUM CURRENT TO OPERATE PLUNGER (AMPS)		DELAY AT MINIMUM Operating CURRENT	MINIMUM CURRENT FOR ZERO DELAY (AMPS)	
		OIL		SETTING						
		GRADE	Temperature °F	HOLE	OVERLOAD %	ACTUAL @ 400 V	REFERRED To 11 kV	(Seconds)	ACTUAL @ 400 V	REFERRED To 11 kV

Fig. 2 (left) is the schedule completed for each characteristic curve. Fig. 3 (below it) is the rubber stamp for relays. Fig. 4 (bottom) for dashpots and Fig. 5 (immediately below) for fuses



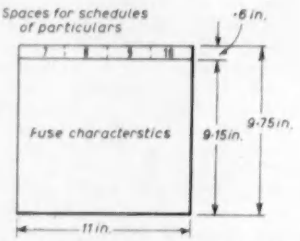


Fig. 6 (top) gives dimensions of the plastic sheet used for relays, dashpots and thermal devices, and Fig. 7 (immediately above) that for fuse sheets. The use of the numbered spaces is indicated in the text below

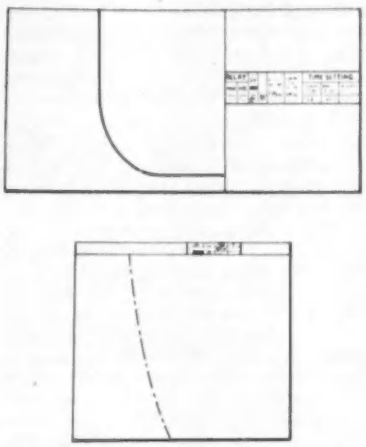


Fig. 8 (top) typical relay curve sheet. The schedule being in space 3 indicates that the curve concerned is usually associated with a h.t. transformer switch. In Fig. 9 (immediately above) the use of space 9 indicates a fuse between 80 and 160 amp rating

dividing either currents or times by a factor (k) does not alter the shape of the curve (as is the case with a linear scale) but merely shifts it bodily up or down or sideways, since

$$\text{Log } (I \times k) = \log I + \log k$$
$$\text{and Log } (I/k) = \log I - \log k$$

This principle is made use of in two ways:

(*a*) The same grid can be used for all voltages involved, e.g., 11 kV, 3·3 kV and 400 V; taking the 11 kV scale as a basis, the 400 V scale is thus obtained simply by moving the 11 kV scale to the left by an amount equal to 11,000/400= 27·5 units, and similarly for other voltages. This fact has some practical advantages in the actual use of the curves.

(*b*) Where a master curve is provided by the manufacturers (as in the case of relays and some dashpots) which has to be multiplied by certain factors such as c.t. ratio, plug setting multiplier, time multiplier, etc., it is necessary to plot one curve only and, by making a template, curves for any particular current and time setting may be drawn rapidly and accurately. An example of such a template is shown in Fig. 11.

For ease of alignment, the curve sheets are trimmed accurately along their time and current axes and a simple Perspex viewer may be constructed, with raised straight edges at right angles against which the sheets are made to lie (Fig. 12). A double-sided "Traffolite" scale (Fig. 13) is also provided, giving the current scales at the different voltages and also the time scale; it is intended primarily for use when curves at two different voltages are being compared, or when the logarithmic grid is not used.

Certain operations are facilitated by the use of a cursor, consisting of a blank sheet of film bearing only the cursor line(s), which is pulled across the graph in a space provided between the back of the viewer and a further (frosted) plate of Perspex, suitably attached. More than one such cursor sheet can be used and a number of applications come to mind, using one, two or even multiline cursors. Two applications are described later in this article.

The transparent material used is "Kodaline sheet film" and, whilst the curves and particulars are drawn on paper and reproduced on the film by a photographic process, drawing ink can also be used on it with success. Care must be taken to avoid distortion during the photographic processing. Once processed, no distortion due to atmospheric conditions is anticipated.

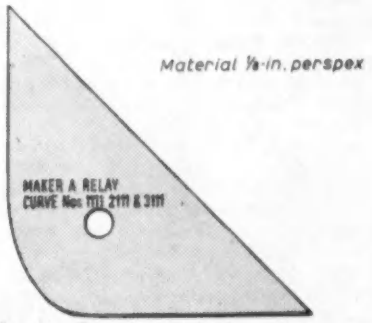


Fig. 11. Typical template for master curve

For easier identification of curves, the various devices are represented differently. Relays have a full line, dashpots a dotted line, fuses a chain dotted line, and thermal devices alternate dashes and crosses.

Reference has already been made to the numbering of curves employing the decimal system, which enables each device to be identified by its number; it now only remains for the rating or setting to be added. The peculiarities of the different devices and the different methods employed by the various manufacturers for adjustment make a standard system impossible but uniformity has been maintained as far as possible. In the case of fuses, the curve number is simply followed by the current rating of the fuse, but where current and time settings are adjustable separately, a

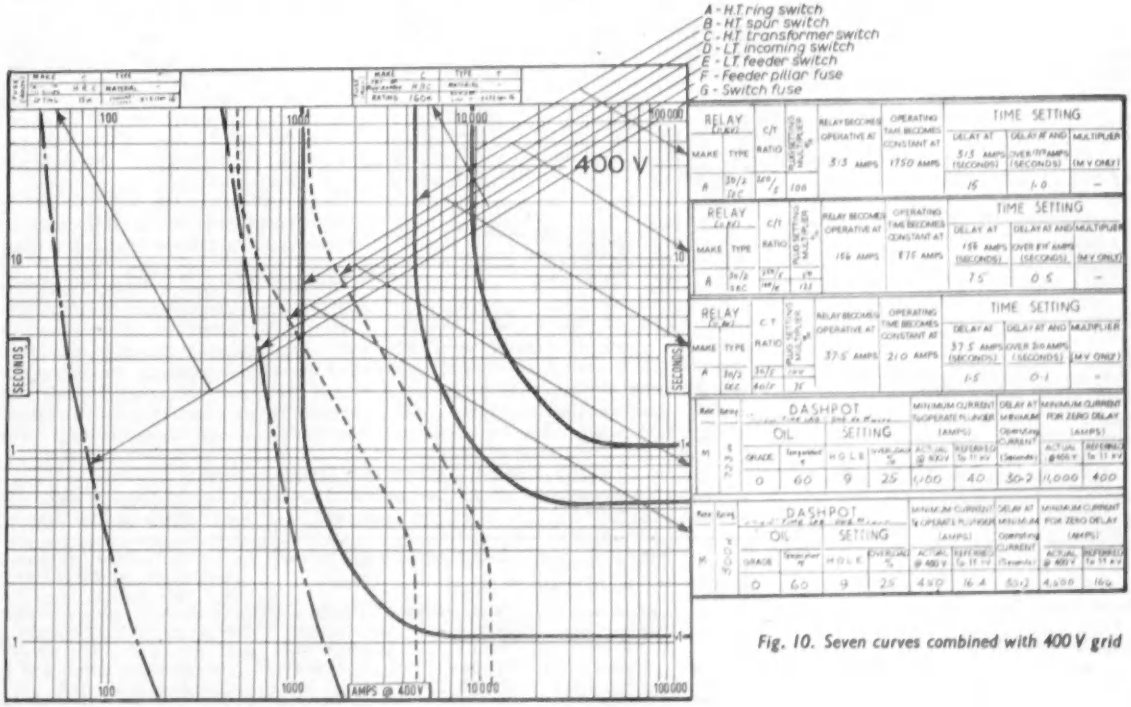


Fig. 10. Seven curves combined with 400 V grid

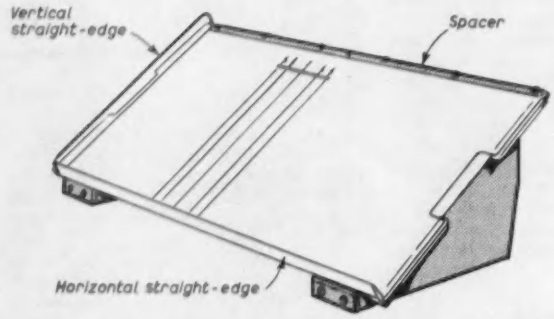


Fig. 12. Special viewer with raised straight edges for holding curve sheets. The cursor shown in position is seen in more detail in Fig. 14

further number to represent the time setting is necessary.

Current Settings: In the case of relays this is given by the product of c.t. ratio, rated relay current and plug setting multiplier divided by 100.

C.T. ratio: 200/5; Rated relay current: 5 amps; p.s.m., e.g. 75%.

Current setting = 200/5 × 5 × 75/100 = 150 amps.

In the case of dashpots, the overload setting takes the place of the plug setting multiplier.

This method is used to prevent unnecessary duplication since obviously the same current setting (and therefore the same characteristic curve) may be obtained by any desired combination of c.t. ratio and p.s.m. (e.g., 150/5 and 100% or 300/5 and 50% etc.).

Time Settings: Relays and dashpots differ in that the former have a definite minimum time characteristic whereas the latter's tends to zero at high fault currents. For relays the definite minimum time given in hundredths of a second is used. For sake of uniformity and to avoid confusion, this system is applied to all makes of relays, including those which employ the "time setting multiplier" calibration. Centiseconds are used to eliminate decimal points.

For reasons stated above, the time settings for dashpots are given in the form in which they are designated by the makers, which is usually the number or size of the by-pass hole in the dashpot. Examples of curve numbers are given in Table 2.

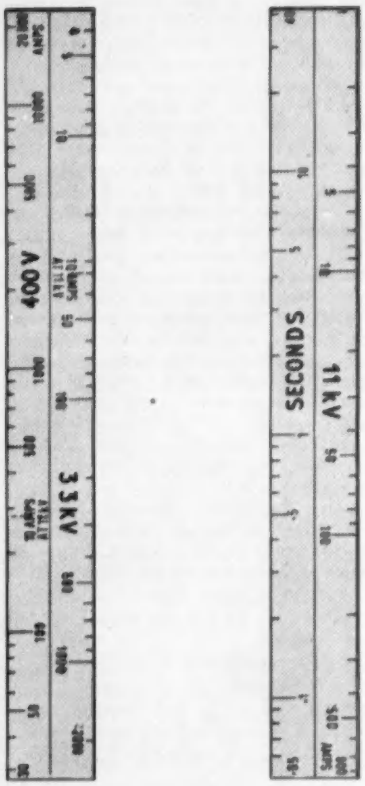


Fig. 13. Double-sided current and time scale. Material: paper sandwiched between 1/16 in. Perspex

Application

Whilst this system can be employed in connection with any kind of protective gear possessing a definite time-current characteristic, it is primarily intended for use on (*a*) overcurrent and (*b*) earth leakage protection, and it is now proposed to illustrate briefly the method of applying it to one or two problems arising out of these eventualities:

(*a*) *Overcurrent Protection:* This may be further subdivided into (i) normal operational overload and (ii) short circuit conditions. There are instances where two protective devices are placed in series, one to look after each of these conditions. One such arrangement is a motor starter with overload protection, backed up by h.r.c. fuses. The latter are capable of clearing short-circuit faults whilst the former is adjusted to have a shorter time lag than the latter on overloads of the order of, say, 50—500% and has the advantage of being easily and inexpensively re-set.

The requirement for such an arrangement is that, if plotted to the same scale and superimposed on each other, the characteristics of these two devices must cross at that current at which it is desired that the h.r.c. fuses should take over from the starter overload device.

On distribution busbars on the other hand, any feeder switch should, under all overcurrent conditions, trip before the incoming switch, and provided that there is only one incoming supply, the incoming characteristic must not cut any of the feeder characteristics and must lie above them. This applies equally to the h.t. transformer switch (the currents having been suitably referred to the l.t. side). Intersection invariably indicates faulty overload discrimination and may or may not show faulty discrimination under short-circuit conditions as well, depending on the relative shapes of the curves and the short circuit level. Fig. 10, for example, shows incorrect discrimination between the h.t. transformer switch and the l.t. incoming switch below 11,500 amps at 400 V (419 amps at 11 kV) and between the h.t. transformer switch and the l.t. feeder switch over the range 1050–4500 amps at 400 V (38–164 amps at 11 kV).

If the curves do not intersect, discrimination under overload conditions will depend on the number of feeder switches, their loads and diversity. Under short-circuit conditions it is almost certain that correct discrimination will be guaranteed, unless the short-circuit level is exceptionally low, when conditions would approximate to an operational overload.

The position is summarised in Table 1 below.

Where there are "n" identical incoming switches, each switch can be assumed to carry 1/n times the total current and by means of the special cursor shown in Fig. 14, the corrected tripping times can be read off directly in one of two ways; either the line marked "1" is set to the fault current and the switch current and tripping time are read off at the appropriate line to the *left* of the "1," or alternatively the switch characteristic may be displaced to the right by a distance proportional to log n, which is conveniently done by moving the "1" line of the cursor to the left hand vertical portion of the curve and moving the curve till that line coincides with the appropriate line on the *right* of the cursor. This latter method has the advantage of placing the curves in their correct relative positions which enables the application of the "intersection check," but in some instances it is more desirable that the curves should not be

TABLE 1. CRITERIA FOR DISCRIMINATION.

Intersection	Operational Overload	Short-Circuits
Yes	Faulty discrimination	Correct discrimination depends on relative shapes of curves and s.c. level.
No	Correct discrimination depends on number of switches, loads and diversity.	Correct discrimination unless s.c. level is very low, when conditions are as for operational overload.

TABLE 2. EXAMPLE OF DERIVATION OF CURVE NUMBERS. COMPARE FIG. 1.

Example	a	b	c	d	e
Voltage	11 kV	11 kV	400 V	400 V	400 V
Device	Ind. Relay	Ind. Relay	Dashpot	Dashpot	Fuse
Make	B	A	M	D	C
Type					
Dashpot Oil (Grade)	—	—	0	0	—
Dashpot temp. °F	—	—	60	60	—
C.T. Ratio	30/5	150/5	—	—	—
P.S.M. %	100	50	—	—	—
Overload Setting (%)	—	—	25	0	—
Current Setting/Rating (amps.)	30	75	300	750	160
Definite Minimum Time (secs.)	0·11	0·30	—	—	—
Hole Number/Size	—	—	9	Medium	—
Curve No.	112/30/11	1111/75/30	331111/375/9	332111/750/M	3212/160

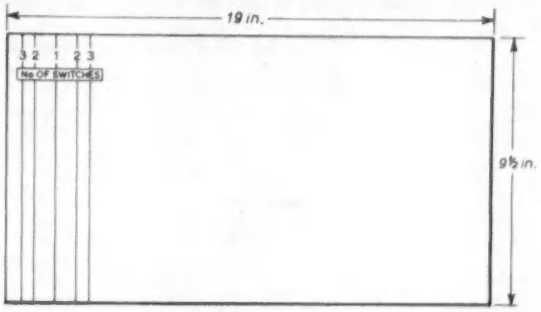


Fig. 14 (left) gives the dimensions of the cursor made from Kodaline sheet film. As stated in the text extra lines may be added for use with starter characteristics

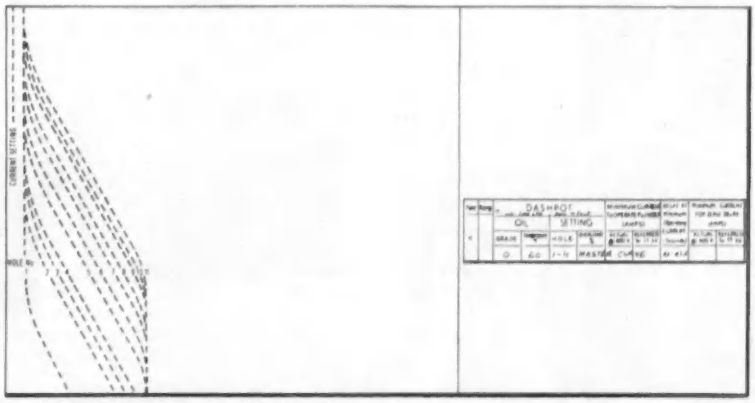


Fig. 15. Typical master curve for starters

displaced from the left hand straight edge of the Perspex viewer.

The lines going towards the right on the cursor may be extended at logarithmic intervals up to 10, and marked "times F.L. current."

These 10 cursor lines marked "times F.L. current" are intended for use with starter characteristics, when it is necessary to determine tripping times at "n" times full load current. In the case of starters, in view of the considerable range of ratings and settings which are inevitably employed, a master curve is generally found convenient for each of the makes and types in use, which will take the place of all the individual curves for particular settings. A typical master curve for a starter with magnetic overloads possessing facilities for varying the time delay by means of different sizes of dashpot orifices, is shown in Fig. 15. Instead of lying with its left hand edge against the straight edge of the viewer, the curve sheet is pulled along the horizontal straight edge until the line marked "current setting" coincides with the rating of the solenoids. Superimposed on the characteristic of the distribution board or feeder pillar fuses from which the motor is fed, and the appropriate grid, the master curve shows readily the dashpot hole which gives the longest possible time delay during overloads, consistent with adequate discrimination. Starting conditions may conveniently be checked with the aid of the cursor.

(*b*) *Earth Leakage Protection:* Conditions for discrimination between core or current balance earth leakage relays are the same as those for overcurrent relays.

When discrimination between earth leakage relays and fuses is to be investigated, conditions depend on the load current in the circuit concerned, since the current in the fuse will be the sum of the load and earth leakage current. At no load, conditions are as for overcurrent discrimination, but when a load current is superimposed, this must be added arithmetically. Two ordinary single line cursors, one for the relay and one for the fuse will be found convenient.

When a new setting has to be determined for a relay, or dashpot, it is convenient to draw the characteristic of the device, with the aid of the appropriate template on an ordinary sheet of paper, and to move it about at the rear of the viewer, until its position in relation to the other associated curves is such that correct discrimination is achieved. The time and current settings to give that position can then easily be calculated.

Conclusion

The above applications merely represent some of the problems met with in practice, around which this system was built up; however, in the light of experience gained in putting it into use, problems will undoubtedly present themselves which will call for certain amendments and improvements.

Besides saving the engineer's time, it is hoped that it will also help foremen and electricians concerned with substation maintenance to clarify these problems in their own minds, where they had previously not fully understood them owing to difficulty in calculating a particular curve for a particular setting from the master curve provided. In consequence it is hoped that cases of incorrect operation of protective gear will be reduced, with the attendant reduction in lost time, due to unnecessary shutting down of plant.

The author's thanks are due to Messrs Imperial Chemical Industries Ltd., for permission to publish this article.

Heavy Machine Tools

BRIEF notes on electrical equipment for heavy machine tools are included in a paper which was read by Mr J. Henderson (C. A. Parsons) to the Manchester Association of Engineers early this month. He suggests that it should be possible to standardise on a range of main driving motors, and to achieve some degree of standardisation with regard to starters and contactor panels. He feels it is worth while going to a slip-ring motor instead of a squirrel cage machine when inching has to be carried out for extended periods during setting.

To use the best control gear is important from the safety aspect and to illustrate this Mr Henderson quotes the case of a very large turbine cylinder boring machine which on three occasions ran away on its own accord, on rapid traverse, and just as mysteriously stopped—after pushing the 20 tons workpiece some distance. In spite of minute examination, no reason could be found for the trouble on the first two occasions, but on the third fine dust was found in the portable pendant which the operator takes inside the workpiece with him. The dust, derived from cast iron, had shorted the rapid traverse contacts.

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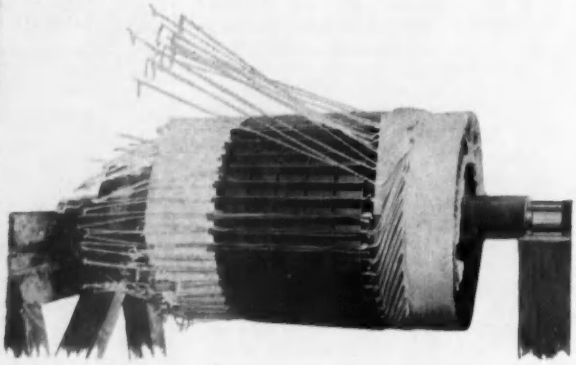

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Brook Motors ZRT Automatic Reversing Starter

DATA SHEET 14

THIS well made industrial type of starter by the old established firm of Brook Motors Ltd., is specifically designed for the automatic reversal of direct-switching squirrel cage motors up to 12·5 h.p. (It is also suitable for certain types of single-phase motors up to 6 h.p.)

It is made in one frame size but six alternative ratings are obtainable, and in addition to the normal self-contained unit it can be supplied on a skeleton chassis, without isolator, for incorporation in machine tools and control panels. The starter can be used either as a normal push button reversing starter with, if necessary, remote control stations and limit switches or as a fully automatic reciprocal control. Mechanical flag "on and off" indicators are fitted to both forward and reverse units and the stop button is mushroom headed and readily accessible.

Weight 17 lb, size 18½ in. x 5 in. approximately. The starter complies with B.S. 587:1940 frequent duty rating.

Construction

The housing is a lightweight die casting with a hinged lid carrying the push buttons (unless remotely controlled). Inside the lid is affixed a diagram of connections and other useful data.

At the top of the case is the isolator switch, interlocked with the lid but provided with a release for operational examination. Below the isolator are two similar contactor panels, forward and reverse, and the lower panel carries the three thermal overload trips. Apart from electrical, mechanical interlocking is provided by a conventional rocking stirrup.

The case is drilled 1 in. top and bottom with additional conduit entries for remote control if necessary. The overload reset is by a push button on the lower left hand side of the case. The whole lay-out is simple and get-at-able.

The Isolator Switch

This is cam-operated by a lever on the top right (A) and fitted with double-break silver inlaid contacts. A fourth pair of auxiliary contacts closes the control circuit.

Contactors

There are two precisely similar except for the omission of the three overloads in the top contactor.

Each resiliently mounted moulded base has four pillars carrying the solenoid coil and also two bearing blocks in which pivots the gravity controlled moulded contactor arm, retained in position by two moulded bearing caps (C) each with one screw fixing. The contactor arm has three extensions (B) each fitted with fully floating spring loaded double break silver inlaid contacts. The arm also carries the mechanical "on and off" flag. Ceramic arc chutes are fitted. On the right of the rocker is a lug which engages (and opens) the auxiliary switch and on the left a metal bracket conveys motion from the solenoid and also operates (and closes) another auxiliary switch (N) underneath the coil. The mechanical interlock is shown at (E).

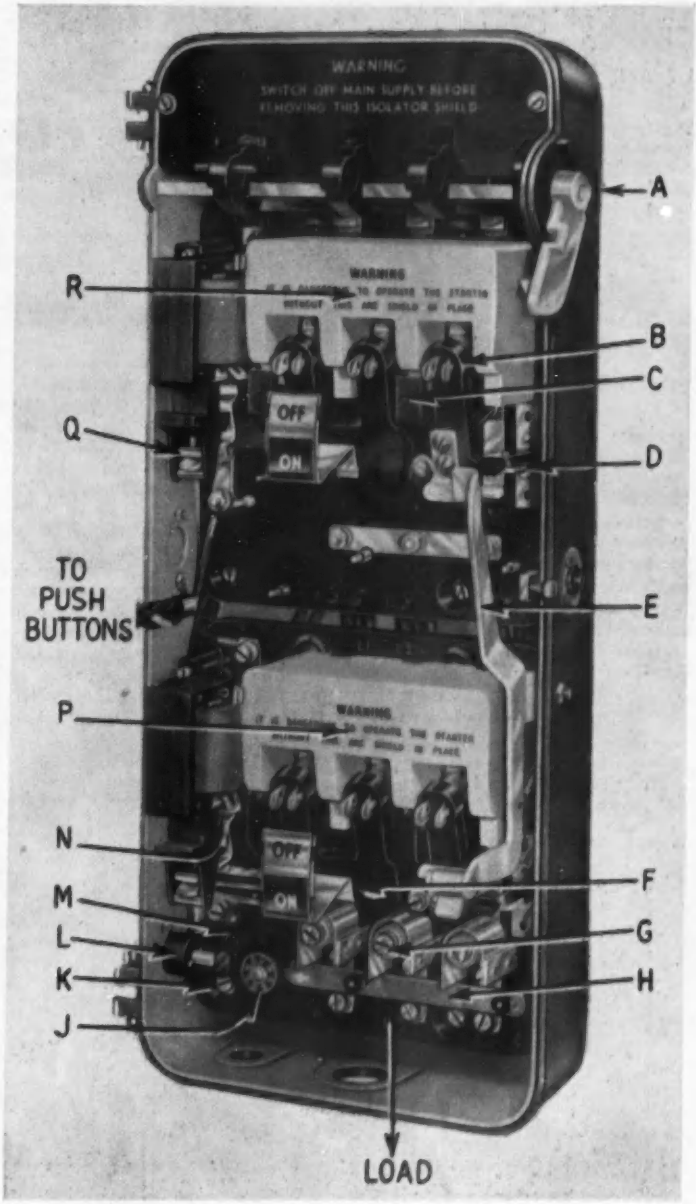


Fig. 1. General view of Type ZRT starter: A, Isolator. B, Moving contact. C, Bearing cap. D, Auxiliary contacts forward (6 and 7, Fig. 3). E, Mechanical interlock. F, Contactor arm. G, Overload unit. H, Trip bar. J, Thermal indicator knob. K, Indicating knob arm. L, Reset knob. M, Reset arm. N, Auxiliary contacts underneath coil. P, Reverse contactor. Q, Solenoid armature and stirrup. R, Forward contactor

The Solenoid Coils

These are fully impregnated coils with flexible tails and are retained in position by spring clips passing through the coil and stampings. They will close the contactor even when the line volts fall to 85% of the coil rating.

Motion is conveyed to the contactor rocker by a stirrup provided with rollers at the point of friction.

Thermal Overload Releases

There are three of these mounted in the lower panel in series with the outgoing terminals serving both contactors. They are of the bi-metal indirectly heated types and are shown in detail in Fig. 2. The trip bar (1) is operated in case of overload by each, or all, of the relays. The end of the trip bar presses on a cam mounted behind the indicator knob (2) and so releases the arm (3) and opens the trip contacts (4) in series with a contactor coil. Adjustment of the cam alters the travel of the trip and so adjusts the current rating.

The indicator knob is calibrated with seven letters which give the amps rating by reference to a metal plate fixed in the starter lid.

The overload release is manually reset (after 1 minute) by pressure at (5) via a button on the left of the case.

Maintenance

As with so many modern contactors servicing is kept to a minimum and wear is negligible, but unlike some other contactors the whole mechanism is visible, an advantage that is self apparent.

Simplicity in design has reduced the number of moving parts to a minimum and "the less the starter is interfered with the more reliable it tends to be".

All contacts are either solid silver or silver faced and should not be cleaned or dressed. When badly worn they are easily replaced by:

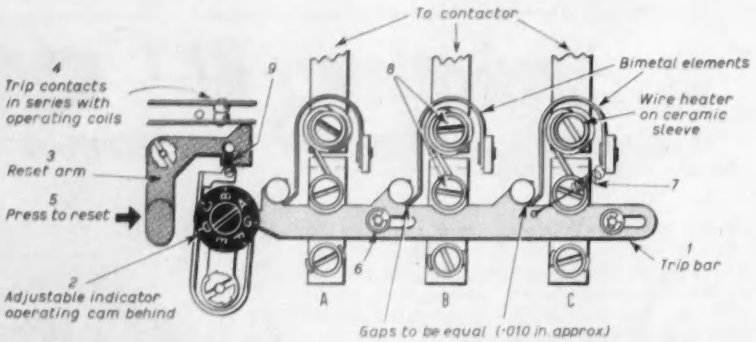


Fig. 2. General view of thermal overload releases and associated components

(1) Unscrewing moulded bearing cap (C, Fig. 1) and removing contactor arm.

(2) The moving contacts will be found bayoneted into the moulded extension arms.

(3) Removal of arm gives access to fixed contacts, each with one screw fixing.

(4) The isolator contacts are also removable, being retained in spring loaded slots in a moulding below the cams.

(5) The auxiliary contacts 1, 2 and 6, 7 and the trip contacts 3 and 4 (Fig. 3) are fixed from the back of the panel.

It should be noted that contacts 1 and 2 are made when the respective contactor closes while 6 and 7 are opened. They can be inspected in operation.

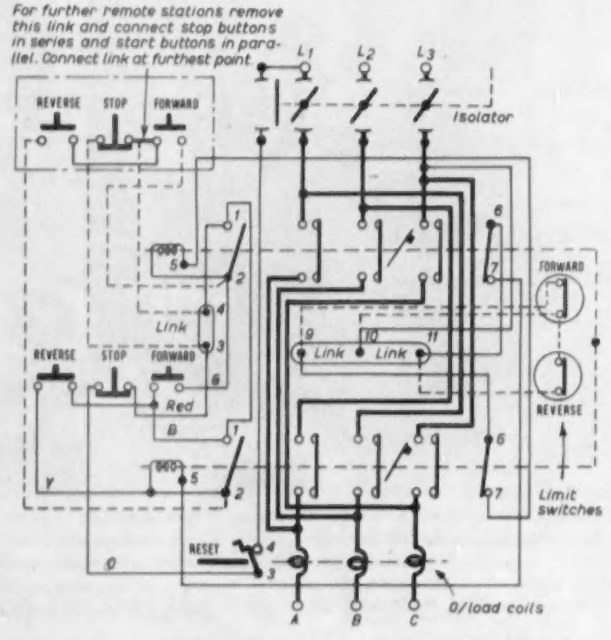
Removal of Coil. After lifting out contactor arm, draw out split pin on top of solenoid and remove spring guides.

Removal of Heater Coils. Remove spring circlip (6) (Fig. 2) and return spring (7). Lower trip bar. Undo screws (8). When replacing heater coils avoid disturbing the setting of the trip bar in relation to the bi-metal elements. Allow ·010 in. of freedom.

The Trip Mechanism. The reset arm (3) and the indicator knob arm (2) are both retained by spring clips on moulded-in pins. These arms must be quite free to move.

All springs are Parkerised but should be frequently examined if working in a corrosive atmosphere. Avoid damage to reset spring (9). (On some models this spring is fitted below the pivot of (2)). Lubrication is not generally necessary. Keep starter and magnet faces clean.

The booklet *Installation and Maintenance of Electric Motors* (published by Brook 3s.) is highly recommended and contains valuable information in general and about starters in particular, together with a list of all spare parts for the contactor under review.



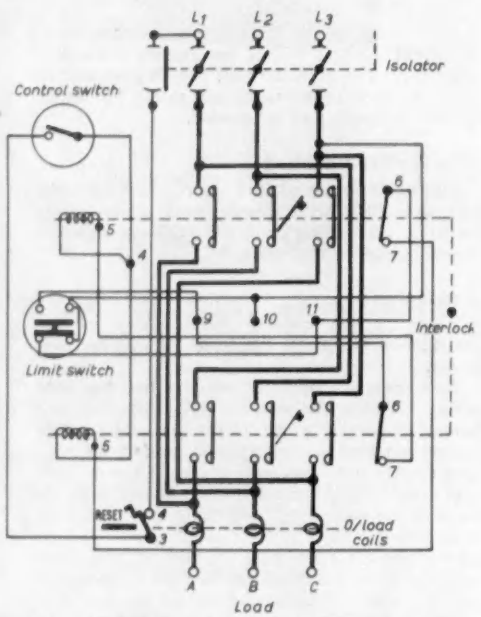


Fig. 3 (left). Shows connections for a standard reversing starter. Remote stations are dotted in. Cable colours are indicated: B, brown. G, green. O, orange, Y, yellow. Link 3–4 has to be removed when fitting remote stop or control station; links 9–10–11 when fitting limit switches. Fig. 4 (right) shows connections for automatic reciprocating control

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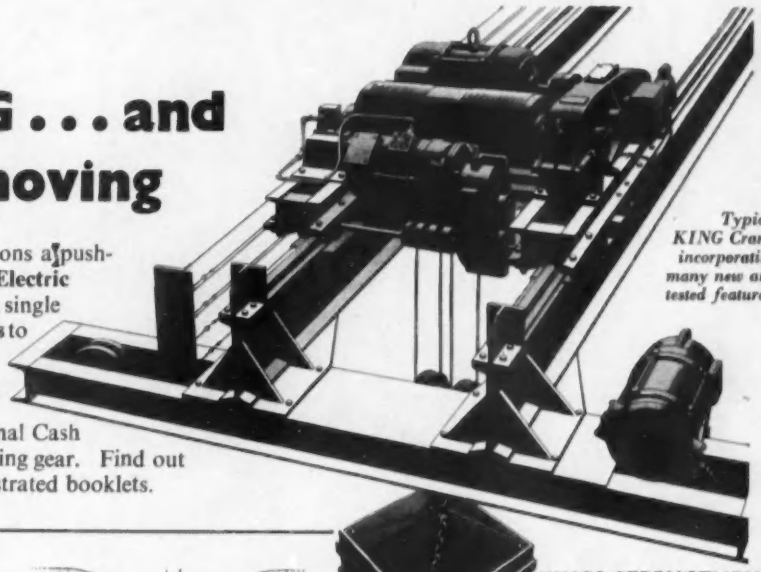

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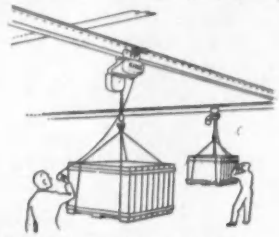

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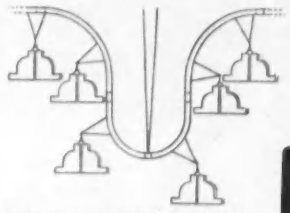

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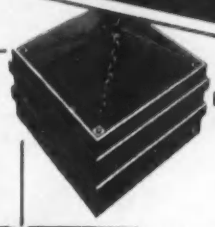

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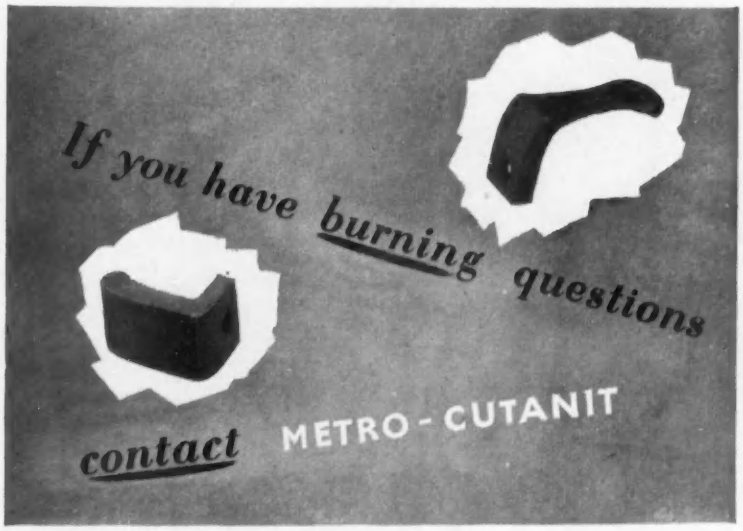

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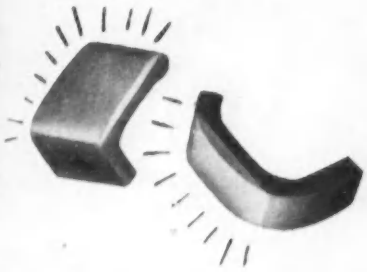

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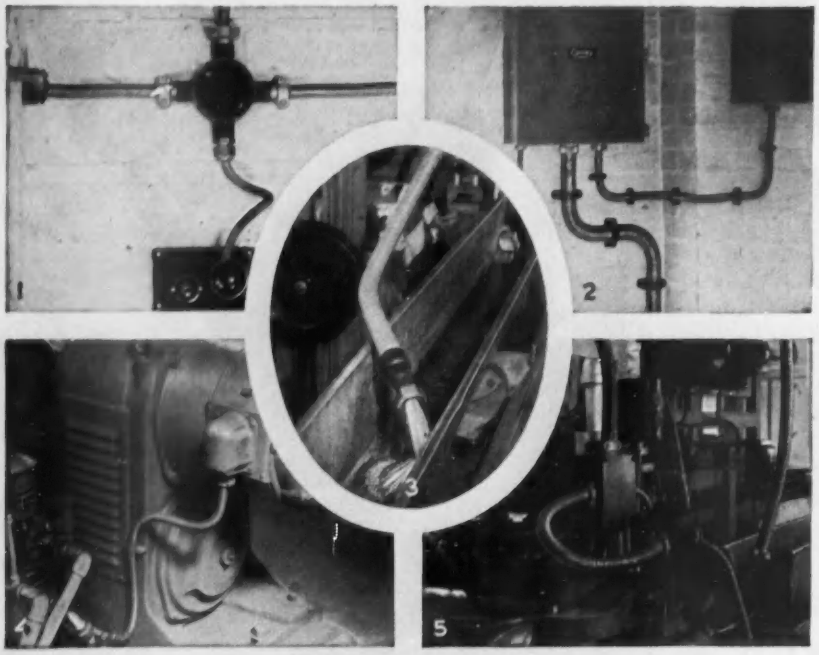

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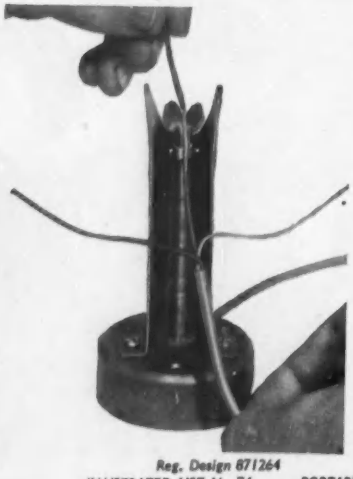

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Care of Electric Trucks

NOTES on the maintenance of electric trucks for internal transport are included in a booklet, "Safety Code for Electrical Power Trucks," published recently by the Industrial Truck Manufacturers Association.* As the title indicates, the booklet goes on to consider the design and operation of such trucks from the safety angle.

On the points likely to be of concern to the electrical maintenance department, particular attention is given to battery charging and changing facilities. It is recommended that all battery charging installations which are separated from the truck should be located in areas specifically set aside and designed for the purpose. Within these areas special attention should be given to providing for the neutralisation of any electrolyte which may be spilled, and to ensuring that fire protection arrangements are adequate. It is also advisable to protect the charging apparatus itself, so as to minimise the possibility of damage by impact with trucks, and to take special precautions to ensure that there is adequate ventilation.

It is recommended in the booklet, that provision should be made for the mechanical removal of traction-type batteries either by an overhead block and tackle, or by the employment of special trolleys. It is considered essential that cell tops should be kept dry and battery terminals completely clean. The latter should be smeared lightly with petroleum jelly and screwed down tightly. Similar remarks apply generally to the filler caps for electrolyte.

Turning now to potentially dangerous details, and associated safeguards, the booklet covers the subject generally by reference to compliance with appropriate British standards. However, there are a number of points selected for special attention. The first is that all switches and control mechanisms should be, as far as possible, enclosed so that access is possible only by the removal of properly fastened shields. Then all exposed wiring should be protected against mechanical injury, particular attention being given to avoiding contact with heated surfaces.

Where possible, it is recommended, totally enclosed or drip-proof motors should be used. When for any reason this is considered impracticable, and open frame motors have to be used, there is emphasis that they should be so arranged that in the event of a burn-out, hot or molten metal or insulation products will not drop out. Resistors should be constructed with means of adequate cooling and mounted in a position rendering them immune from mechanical interference.

It is considered desirable that all electrically powered trucks should be arranged so that it is impossible to apply the brakes while the driving motor is under power. Further, all electrically powered machines should be provided with a device capable of completely immobilising the truck. On electrically powered trucks, electrical switchgear should be provided to ensure that when the driver leaves the machine unattended, no power can be transmitted either to traction or elevating circuits.

Finally, there is emphasis in the manual on the desirability of considering internal transport when factory lighting is being planned or reviewed. Where general lighting is unsatisfactory, and improvement uneconomic, consideration should be given to the possibility of incorporating auxiliary lighting on the truck itself.

94 Petty France, London, S.W.1. The booklet is price 2s. 6d., post free.

Lighting in Colliery Buildings

THE National Coal Board recently published their schedule of illumination values for colliery surface buildings, providing a useful indication of N.C.B. practice measured against the values recommended in the I.E.S. Code for the lighting of building interiors. The N.C.B. schedule has been provided to give guidance to engineers concerned with designing interior lighting installations. The following table is an extract from the schedule, which gives levels of illumination measured in the horizontal plane, 3 ft above floor level. In each case, the lower figure in the range is to be normally regarded as the minimum to be attained, the desirable standard being generally the upper limit.

For those colliery buildings which come within the scope of the I.E.S. code of practice, it is seen that the schedule conforms generally to accepted lighting practice. Of particular items, the recommendations for picking belts are a little above those in the Code, which suggests an illumination of 20 lumens/sq ft. On the other hand, the recommended level for garage repair work of 12 to 15 lumens/sq ft is to be compared against the I.E.S. value of 20 lumens/sq ft. The other important item worthy of note is the recommended level of lighting for drawing boards. Where the N.C.B. schedule suggests 20 to 25 lumens/sq ft, the I.E.S. value is 30 lumens/sq ft. Values quoted in the schedule, however, are without prejudice to any additional lighting which may be required due to the nature of a specific task.

Accompanying the schedule are notes discussing factors involved in planning a lighting installation. It is pointed out that the size and nature of the object to be seen, its characteristics, reflection, colour and contrast against its background, whether the object has movement, and the duration of the seeing task are some of those to be considered. They have been taken into account in assessing the range of illumination values given in the schedule. Emphasis is given to the main conditions governing the quality of a lighting installation, referring to the importance of the location and brightness of both sources and reflecting surfaces illuminated by them to ensure adequate control of glare, the distribution, direction and diffusion of light, and, finally, the spectral composition of the light. Moreover, attention is given to a number of factors related to the building interior.

RECOMMENDED NOMINAL SERVICE ILLUMINATIONS FOR COLLIERY SURFACE BUILDINGS

Location	Illumination L/sq ft	Location	Illumination L/sq ft	Location	Illumination L/sq ft
Canteens:		Fan house	7–10	Offices:	
Customer's space	7–10	Fire station	7–10	Typing, accounting, etc.	15–20
Kitchen	7–10	Garage:		General and private	12–15
Coal preparation plants:		Repairs	12–15	Power house	7–10
Working areas	7–10	General maintenance	7–10	Rescue room	10–12
Other areas	4–6	Lamp room:		Stores:	
Picking belts	20–25	Main area	7–10	Despatch area	7–10
Compressor house	7–10	Repair section	12–15	Storage area	4–6
Drawing offices:		Medical centre:		Transformer house	2–4
General	10–12	Treatment room	12–15	Weigh cabins	6–8
Drawing boards	20–25	Physiotherapy room	10–12	Winding houses	6–8*
Electric substation	7–10	Doctors' and nurses' rooms	10–12	Workshops	12–15

Plus special lighting for indicators, drum pits, etc.

CHECKING D.C. FIELD CONNECTIONS

by S.X.

WHEN internal connections of a d.c. machine have been broken for repair or overhaul, progressive tests during reassembly and subsequent no-load tests of the complete machine can do much to ensure that the connections have been remade correctly. A systematic approach to such testing is most desirable. The present article describes a system which has proved reliable, but no claim is made that it is the only possible way of proceeding.

As an example, consider a four pole compound d.c. motor with interpoles, on which the field coils and interpoles have been rewound. (Fig. 1.)

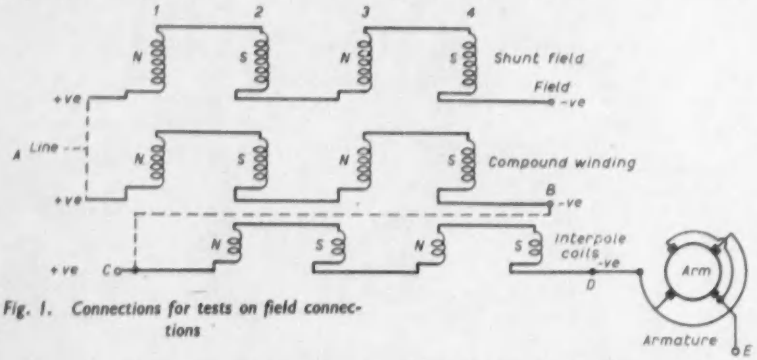


Fig. 1. Connections for tests on field connections

(*a*) *Connecting by inspection.* It will be found convenient to arrange that flexible ends leave the coils in the direction of winding. If this is done, when the coils are assembled in the machine frame, the polarity can be determined visually. Coils should be connected alternatively "open" and "crossed." This applies to all the windings, shunt, series and interpole.

(*b*) *Electrical check before assembly.* Pass a d.c. current through each of the three windings *in turn*, and check that the polarities are correct, e.g., alternately N-S-N-S, say in a clockwise direction seen from the commutator end. If the shunt and compound windings, while each running in a correct sequence, are of opposite polarities on each individual pole, reverse completely *either one* of these windings, to ensure that they are cumulative in action. (Fig. 1). Mark with chalk the resulting polarity of each main pole. Maintain the common connection at A (Fig. 1) as permanent, in order to preserve these conditions.

This leaves the interpoles to be dealt with. Individual polarities have been established as correct, but there is an additional requirement that the sequence bears a definite relation to the direction of rotation of the armature. The rule that applies is: the interpole polarity is an extension of the main polarity in the direction of rotation (see Fig. 2).

(*c*) Apply a d.c. current to the interpoles by moving the positive test lead from A to C and passing the current from C to D (Fig. 1). Mark with chalk the resulting polarity of each interpole. If this polarity happens to agree with that shown in Fig. 2, then for satisfactory commutation, the direction of rotation when the motor is run up should be clockwise when looking on the commutator. For the alternative sequence, of course it is anti-clockwise.

All joints between the coils can now be made permanent, and the field system finished off ready for the insertion of the armature. Connect the compound winding in series with the interpoles by joing B to C (Fig. 1).

(*d*) *Electrical check after assembly, at partial voltage.* To determine the no load brush position connect a millivolt meter across the brushes of opposite polarity, and flash the shunt winding with a very small d.c. current; move the brush rocker either way until the minimum deflection is observed on the voltmeter; flashing the shunt field at each shift. Mark the brush rocker at this position.

(*e*) Connect the motor at well below rated voltage and allow it to run up, noting the direction of rotation. If it runs clockwise looking on the commutator (*c*) all the internal connections can be assumed correct; but should it run anti-clockwise interchange the two leads on the brush rocker; in other words reverse the *armature only* at D and E (Fig. 1).

(*f*) *To check the compound winding.* Disconnect the shunt field lead, put the starter on the first stud, if the motor again runs clockwise as before the compound winding are correct. If the rotation is anti-clockwise, the compound winding is differentially connected.

(*g*) *To check the interpoles.* Move the brush rocker half a main pole pitch in the direction of rotation, put the starter on the first stud; if the motor again runs clockwise the interpoles are correctly connected. Return the brush rocker to the no load position.

There is one precaution which should be taken when carrying out this test If it is a compound machine, the compound winding can cause misleading results and it is advisable to bridge over this part of the circuit so that the test current passes through the interpoles and armature only.

The equipment required includes the following:

A low voltage d.c. supply of say 50 V maximum from a separate generator with which most repair shops are equipped for drop testing.

A compass with a fairly large needle, whose polarity is not easily reversible.

A low reading voltmeter, preferably central zero.

A heavy duty starter of say 20 to 30 h.p. at 460 V; this will be suitable for quite a large range of motors and embody a sufficiently large and robust resistance to withstand all that is required of it by an experienced tester.

It is an advantage to remove the return spring on the starter contact arm to enable the first contact to be engaged, and use a d.p. switch to interrupt the supply and so avoid burning up the first contact.

The motor can now be confidently connected to the supply at full rated voltage and if the direction of rotation is reverse to that required by the load it is to drive, it is purely a matter of following recognised procedure for reversing, *i.e.*, use C as the armature terminal and connect B to E. Should the direction of rotation with which the motor is to operate be known before hand the interpole connections can be arranged accordingly during test (*c*).

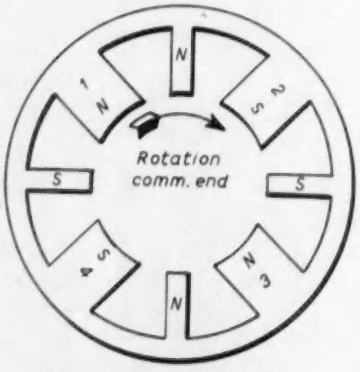


Fig. 2. Correct interpole polarity

Such step by step checking of connections as described might convey the impression that it is a drawn-out affair; but it costs much more in labour to dismantle and correct mistakes afterwards.

One final point; if the machine is a d.c. generator proceed in the same way and treat it as a *motor*. But in doing so the compound winding must be connected *differentially*; i.e., in (*b*) the shunt and compound windings must have different polarities on each pole.

PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

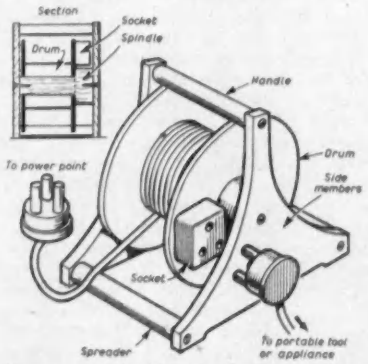
Condensation in Motors

THE choice of a totally enclosed motor is often necessary due to site conditions and while these may exclude the entry of harmful material a totally enclosed motor does permit condensation to occur. It is surprising the amount of condensate which will accumulate inside a motor and a recent case, of a comparatively small motor of 10 h.p. suffered a breakdown due to condensate having accumulated to such a level as to immerse a portion of the stator windings. There were clear markings on the inside of the endshields indicating the depth to which water had accumulated.

In this case site conditions permitted the use of a drain hole in the bottom of the stator thus allowing condensation to escape. In many cases it is possible to use a drain hole or drain plug but in the case of flameproof machines the solution is not quite so simple and some form of breather is necessary and this in itself must be flameproof.—"*Torque.*"

Reel for Long Leads

LONG extension leads for use with portable electric tools are very useful but their storage and handling is not usually carried out in the most efficient manner. If carried around in the form of a coil, they inevitably become a tangled mass of writhing snakes when brought into use. They become dirty and are in danger of being cut by the dropping of heavy objects on them. They constitute an industrial hazard when spread around on the floor.



Arrangement of cable reel with socket for long leads on portable tools

An empty cable drum and some pieces of plywood can be converted to a very efficient storage drum for long leads up to about 60 ft in length. The cable drum has plywood sides and a cardboard centre cylinder. Originally, the plywood sides were 11 in. diameter but these were sawn down to 8 in. The side members of the drum stand were made from ½ in. thick "Weyrock" but any suitable material, such as ½ in. plywood, can be used. The three spreaders between the side members are made from 1 in. diameter dowelling, or broom handle stock.

The original drum had a central hole of 1½ in. diameter in each side and a cylindrical spindle on which this can revolve was turned in a lathe. One end of the spindle is enlarged in diameter so that it forms a spacer between one side of the drum and one of the side members. The spindle is secured to the side members of the stand by means of long wood screws.

The space formed by the enlarged spindle end is to allow a standard three-pin socket to be mounted on the exterior face of the drum which can be revolved on its spindle without the danger of the socket making contact with the inside of the side member.

One end of the long lead is connected up to the socket and the other end is fitted with a plug for connection to the supply. The plug from the drill or other portable appliance is plugged into the socket in the side of the drum after the desired length of lead has been paid out. Any surplus cable stays on the drum which is prevented from revolving by the plug engaging with the socket. When the lead is no longer needed, it is readily wound back on to the drum.

The top spreader forms a convenient carrying handle for transporting the drum to any working position. One advantage of this form of construction is its simplicity; no contact rings and brushes need to be employed to convey the supply from the lead to the appliance being used.—*C. T. Bower.*

Carcase Wiring Tip

BUILDING jobs often present the illuminating spectacle of a minor war between plasterers and "sparks" for a piece of wall. Against guerilla movements, the installation men frequently suffer from the handicaps of insufficient knowledge of exact positions and the need to plan the work as a whole before any one item of wiring is fixed.

An interesting sidelight is presented when flush type steel boxes are installed; the tiny tapped holes, usually 4 B.A. in switch and socket-outlet boxes, for fixing the accessories, are invariably filled with cement rendering. Clearing the holes usually means both mutilating the internal threads and then laboriously tapping the four holes in either 15, 5 or 2 A socket-outlet boxes. In quite a number of cases, due to their awkward positioning, the tap breaks close to the hole and then the fun really begins.

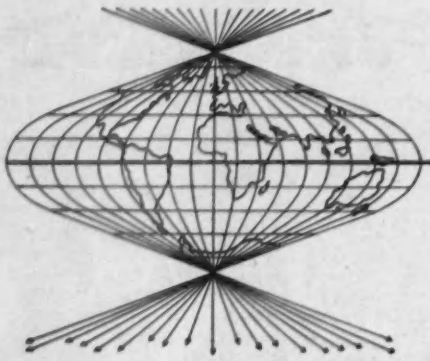
Even if all is successful, unless—all too rare—a perfect drying takes place, should the accessory require to be replaced one finds that the threads previously scrapped by turning through the tapped holes have become rusted in solid; attempted withdrawal spoils the screw-head and often the screw snaps. The solution is simple, a spot of grease or vaseline if placed in the tapped holes on fixing resists the ravages of the insidious cement and makes for more efficient installations.—*M. N.*

Hot Clothes Line

I WAS recently called to investigate a fault in a new council house and, while the fault proved to be fairly simple in origin, its effect was, to say the least, startling! The installation in this house, one of a number on a new site, had been completed, tested in the usual way and left ready to receive a meter. However, other tradesmen had a little work to do on the premises, and so it was some days later, on the consumer taking occupation, that the meter was installed.

The meter fixer reported that as soon as he had connected the supply, a fuse blew and the consumer rushed in to say that the clothes line in the kitchen had caught fire and fallen down! I immediately investigated and found that the clothes line consisted of a length of plastic covered spring steel curtain wire. This was fitted with the usual eyes on each end, and the consumer had fixed this by means of some old wire between a convenient water pipe along one wall and a gas pipe running along the opposite wall. No gas meter had been installed so it was obvious that the gas pipe had become alive in some way.

An insulation test indicated an earth on one of the power circuits, and it was discovered that a gas point had afterwards been fixed adjacent to the power point, and the fitter, in fixing same, had driven the fixing screw in so badly that it had damaged the insulation on the wire behind the power point pattrass, and was making contact with the core. It seems that while every effort is made to keep electricity installation well clear of gas the reverse occurs only too often. This is the first occasion I have encountered a clothes line which was heated!—*W. T. Wedlake.*



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Ontario's Position

For the first time since World War II the Hydro-Electric Power Commission of Ontario would have enough power to look after the needs of all its customers, Dr Richard L. Hearn, the commission's chairman, has told the annual meeting of the Ontario Municipal Electric Association. This had been made possible, he said, by the production of the new Sir Adam Beck No. 2 generating station at Niagara Falls. Seven of its 12 units had been completed; when the other five were finished—after the St. Lawrence power project was completed—it would be able to produce 1,400,000 horsepower, he said. Dr Hearn said the commission's capacity had risen 16% last year, reaching a peak of 22,386 million kWh. It was the first year in which Hydro was even able to export power—1,420 million kWh—to the U.S.

Contractors' Organisation

Steps have now been taken to form a Canadian Electrical Contractors Association to organise contracts throughout the Dominion, and to publicise their services more fully, it is stated. There are already associations representing electrical contractors in various provinces, and the intention, it seems, is to ask members of these groups to delegate a representative to the national organisation. The organising committee is at present headed by Mr L. Tremblay, president of the Quebec Corporation of Master Electricians, and Mr R. De Mers, of the Electrical Contractors Association of Ontario, with Mr F. Gubert, president of Bedard-Girard, of Montreal, as treasurer. It is intended that the new organisation should have headquarters in Ottawa, but temporarily, the facilities of the Quebec Corporation, in Montreal, will be utilised.

Manufacturers' View

Perturbed at what they term a serious recession as a direct result of foreign imports, the Canadian Electrical Manufacturers Association have circulated a 100-page report on the question, which has been prepared by a group of economists. In this it is shown that from 1950 to 1953 total imports of electrical equipment into Canada increased from $116·2m to $281·7m (140%). In 1948, electrical imports took 15·4% of the market, but by 1953 the figure had risen to 23·7%, the highest level since 1929. During 1954, import competition maintained its 1953 level, but the Canadian market for electrical goods declined, causing unemployment and loss of income in the Canadian industry. Production had, in fact, dropped by one-sixth from the 1953 peak. The report states that the industry has been harassed by the lowering of Canadian tariffs under the G.A.T.T. agreements. The average tariff protection afforded the industry is now less than at any time during the past 75 years. Imports of many types of electrical goods are subject to a tariff of 22½% under the most-favoured-nation schedule, and a tariff of 15% under the British preferential schedule. It is considered, however, that the increase in value of the Canadian dollar and devaluation of foreign currencies have almost wiped out these tariff advantages to Canadian manufacturers.

URUGUAY

Tenders in Hand

The Uruguay State Electricity Board are now considering tenders for the construction of a new hydro-electric plant at Rincorn de Baygorria, on the Rio Negro. Estimated cost of this work is 160m pesos of which half is to be financed by a loan from the International Bank for Reconstruction and Development and the remainder by means of internal loans. The Rincorn de Baygorria station is intended to supplement the existing station at Rincorn del Bonete.

SCANDINAVIA

Power Export

The County Council of Tröndelag has voted against concessions to be granted by the Government for export of hydro-electric power to Sweden. Tröndelag's main city, Trondheim, has contracted—pending Government concession—to export electricity to Stockholm. As we reported on 25 Nov., under revised proposals, it was suggested that a new power station to produce 600m units annually should be constructed on the River Nea not far from Trondheim. Stockholm, which would provide 84m kroner of the 100m kroner needed to build the plant, would receive half the power generated at the very low rate of 2½ Norwegian öre per kWh. Although the Norwegian government is in principle in favour of power exports to Sweden, when concessions are involved there has been opposition.

EUROPE

Luxembourg's Transport

Electrification of heavy traffic lines connecting Arlon (Belgium) with the French line to Thionville will probably be undertaken in 1956 and it is planned to make Luxembourg city the point of junction between the Belgium 3,000 V d.c. and the French high voltage 50 cycles systems. Traction through Luxembourg would be by French or Belgian locomotives as the Luxembourg railways do not intend acquiring any of their own for the time being. On the lighter traffic lines in the rest of the country the Luxembourg railways intend eliminating their remaining steam locomotives and replacing them by diesel/electric engines, of which they have bought a number since the war.

International Scheme

The construction of large hydro-electric projects in Yugoslavia which would export power during parts of the year to Italy, Western Germany and Austria, is suggested by a group of experts set up by the Economic Commission for Europe. These engineers have recommended that a committee be set up at inter-governmental level, under the auspices of the Committee on Electric Power, to facilitate the necessary negotiations. The main project comprises the construction of four hydro-electric plants and a high-voltage transmission network on Yugoslav territory. In addition, various generators would be added to a power station already under construction. Most of the power would be generated during the winter. Italy, Western Germany and Austria would import progressively larger amounts, their total imports reaching 4,300m units on completion of the work. Total output of the plants is estimated at 6,400m units, and the capital cost $309m, plus $110m for erecting transmission lines.

S.W. ASIA

Hirakud Progress

A total of Rs.358m had been spent up to the end of November last on the construction of the Hirakud hydro-electric and irrigation project, according to a

report presented by the Public Accounts Committee to the Orissa State Parliament. Mr T. Iyengar, the chief engineer, states that the dam should be substantially completed for power generation and irrigation by Aug., 1956.

A New Authority

It is proposed to set up a West Pakistan Power and Projects Authority. This organisation will operate as a semi-autonomous body under the Provincial Government and will execute hydro-electric schemes and other power projects in addition to other major schemes for irrigation, flood control, etc.

GREECE

Progress in Athens

Preparations are now in hand for extending the St. George's Bay power station of the Athens Piraeus Electricity Co., illustrated below. As we have already recorded, the approval of the Greek Government was obtained for the scheme and a contract negotiated with the English Electric Co., Ltd., for the supply, erection and commissioning of the extension, together with the supply of transmission and substation equipment for extending the network. The new generating equipment will comprise two English Electric turbo-alternator sets, one being a 60 MW hydrogen-cooled machine and the other a 14 MW topping set, both operating at 900 p.s.i.g. and 900° F. Three Mitchell Engineering 930 p.s.i.g. and 915° F boilers will be installed, two being equipped for burning either pulverised lignite or fuel oil and the third for fuel oil only. The m.c.r. of the boilers when burning lignite will be 330 klb/hr and 400 klb/hr when burning oil. The steam not required by the 60 MW set will be taken through the topping set, or alternatively through pressure and temperature reducing equipment, exhausting into the low pressure mains of the existing station, and steam from this source will take care of about 80% of the full load requirements of the four existing turbo-alternators. The output from the 60 MW alternator will be stepped up to 66 kV through a 72 MVA transformer and from the 14 MW set through a 17·5 MVA transformer on to the existing 22 kV busbars. An inter-connection will be provided between the 66 kV busbars of the extension and the 22 kV busbars of the existing station through a 37·5 MVA transformer. Transmission of the output of the 60 MW set to a receiving station at Rouf, on the outskirts of Athens, will be by a 66 kV double circuit o.h. line about 6 miles long and from there to Gyzi substation by 4 miles of 66 kV underground cable; at these two substations 45 MVA step-down transformers will feed into the 22 kV network. The British owned and managed Athens Piraeus Electricity Co., Ltd., which supplies the City of Athens and its environs within a radius of 20 kilometres, including the port of Piraeus, having a total population of about 1,450,000, owns two power stations, one at New Phaleron, which was the original station, and the other at St. George's Bay built in 1926. At St. George's Bay the installed capacity is 60 MW, comprising three 15 MW E.E.C. sets installed when the station was built, and an A.E.G. 15 MW set added in 1938. Since the war the capacity at New Phaleron has been increased from 12 MW to 70 MW by the installation of turbo-generators, both l.p. and h.p., totalling 41 MW and of diesel engines totalling 17 MW. In 1953 a contract was negotiated with the state owned Public Power Corporation for the supply of 60 MW interconnection between the Corporation's 150 kV system and the company's network being by means of 50 MVA step-down transformers at Rouf and Eleusis substations. The main transmission network at present comprises about 260 miles of 22 kV o.h. lines and underground cables feeding 23 main substations supplying the 6·6 kV distribution system. The maximum demand on the system has increased from 45,700 kW in 1939 with a consumption of 188m kWh, to 174,000 kW last year with a consumption of about 730m kWh. Consumers have increased from 168,000 pre-war to about 248,000 at the end of last year.

AUSTRALIA

Exhibit No. 1

Construction of a standard Western Queensland power station designed to serve isolated townships with populations of up to 1,000 will be a feature of the State Electricity exhibit at this year's Queensland Industries Fair. The Electricity Commissioner, Mr H. N. Smith, has said there would be a complete installation of plant and associated equipment shown under operating conditions. Twenty of these stations had been erected in the past three years, and more are under construction. The 1955 Industries Fair, promoted by the Queensland Chamber of Manufacturers, will be held from 9 Apr. to 2 May.

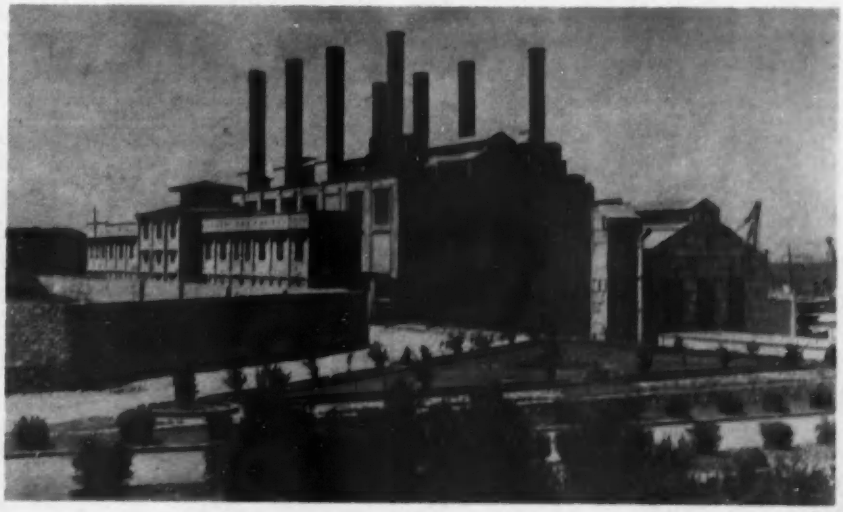
Line in Commission

The new 110 kV transmission line from Trevallyn, Tasmania, to the Aluminium Commission works at Bell Bay has been completed and placed in service. The steel towers for the line, which is 28½ miles long, were manufactured in the Hydro-Electric Commission's workshops at Moonah, and erected under contract by Electric Power Transmission Pty. Ltd., of Sydney.

NEW ZEALAND

Plant for Geothermal Scheme

Still very optimistic of the possibility of utilising geothermal steam for the production of electricity at Wairakei, North Island, the New Zealand Government is now seeking to contact manufacturers who are prepared to submit tenders for the supply of suitable generating plant. At the moment it is envisaged that three low-pressure turbo-alternators of about 11 MW rating each will be required at least up to the second stage of the scheme. These machines would operate on dry saturated steam at about 0·5 lb/sq in. g., exhausting into jet condensers. In addition, probably two back pressure sets of smaller size would be wanted to operate on steam, at inlet and exhaust pressures of about 180 lb and 50 lb/sq in. g. respectively. Consulting engineers for the project are Merz and McLellan. So far five major geothermal bores have been drilled at Wairakei, but not all of them have proved a success. But in view of recent developments there are high hopes that the further drilling to be undertaken will provide the additional steam required for power generation.



St. George's Bay power station, Athens, showing the temporary ends to the turbine room and boiler house, which will be removed for the extension to be made, as noted above

Personalities IN THE INDUSTRY

Mr R. C. Davidson has been appointed assistant sales promotion manager, Frigidaire Division of General Motors Ltd. He joined Frigidaire's Sales Promotion Department in Jan., 1954, being previously a staff instructor with Hoover Ltd.

George Kent Ltd. have appointed **Mr C. W. Chandler** as manager of their Hibbert St Works in Luton, where they manufacture f.h.p. motors, meter dials, etc.

The Council of the Conférence Internationale des Grands Réseaux Electriques, on the proposal of the British Committee, have appointed **Dr Percy Dunsheath,** C.B.E., M.A., an honorary member of that body as an expression of gratitude. Dr Dunsheath has attended nearly all the conventions and his efforts have brought to them an efficient co-operation.

Col F. A. Neill, chairman and managing director of James Neill and Co. (Sheffield) Ltd., has resigned as chairman of the East and West Ridings Regional Council of the Federation of British Industries. This follows his nomination as High Sheriff of Yorkshire. Col Neill, chairman for just over a year, is succeeded by **Mr F. Bowen,** deputy chairman and a member of the regional council since 1947.

Assistant head of the Department of Electrical Engineering, College of Technology, Birmingham, **Mr D. H. Ray,** B.SC., M.I.E.E., A.C.T.(B'HAM.), will take up his duties as Head of Engineering Department, Mid-Essex Technical College and School of Art, Chelmsford, in April. Mr Ray served his apprenticeship with the Shropshire, Worcestershire and Staffordshire Electric Power Co., and became assistant to the chief control engineer. He was released from the Army for training of radio mechanics at the College of Technology, Birmingham, where he took a permanent appointment after the war. He is a member of the South Midland Centre Committee and Secretary of the South Midland Education Discussion Circle of the I.E.E.

The factories within the A.E.I. group concerned with the design and manufacture of electric lamps and lighting equipment have recently been regrouped. **Mr S. R. Eade,** M.I.E.E., who has been manager of the B.T.H. lamp factories since 1949, has now been appointed general manager, lamp and lighting manufacture. In that capacity he is now responsible for the Lamp and Lighting Divisions of Manufacture in the factories at Ponders End (including Hitchin) and Hereford (including Rea St, Birmingham). In addition the following factories remain under Mr Eade's management: Rugby (Lamp Works), Leicester (Melton Rd), Lutterworth (semi-conductor section) and Stoke-on-Trent (Trent Vale). Mr Eade joined B.T.H. as an apprentice in 1924, subsequently spending ten years in the Research Laboratory, chiefly in connection with aspects of sound recording and reproducing equipment. In 1939 he became lamp works engineer, responsible for the design and construction of all lamp works plant, factory layout, building services, and factory engineering. Between Oct. 1945 and 1949 he was manager of the B.T.H. lamp factory at Melton Road, Leicester.

Mr R. M. Campbell has joined the board of Gresham Transformers Ltd. A management consultant by profession, Mr Campbell is an executive of the Wallace Attwood Co. with a wide experience of correlating the functions of Sales, Design and Production Departments, both in this country and the U.S.A.

Dr E. D. Adrian, Master of Trinity College, Cambridge, who was awarded a barony in the New Year Honours, becomes **Baron Adrian of Cambridge,** in the County of Cambridge.

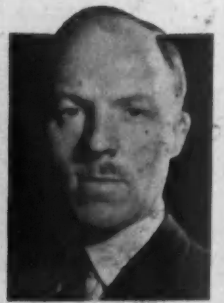
The Thermovent Heating Division of E. K. Cole Ltd. announces the appointment of **Mr R. E. G. Durham,** as technical sales representative for the Midlands area. Mr Durham, who succeeds Mr B. I. Nealon, operates from the company's Birmingham depot.

Mr H. Broadbent, resident New South Wales director, for H. Rowe and Co., Pty. Ltd., accompanied by Mrs Broadbent, left Sydney, Australia, in the *Iberia* earlier this month for an extended overseas trip. He is to visit the Company's overseas Principals, and attend the Rheostatic Co.'s International Conference, at Slough. Whilst in England he will spend some time at various exhibitions and will go on to Continental Fairs. Mr Broadbent will visit Germany, Czechoslovakia, Spain, Portugal, Italy and France, and the U.S.A., where he will spend some time investigating the latest trends and ideas in electric cooking, domestic and fluorescent lighting and general electrical engineering products produced in the Rowco factories. He will join the s.s. *Orcades* in Vancouver towards the end of the year for his return to Australia.

Mr S. Tillotson, A.M.I.E.E., manager of the Tees Sub-Area of the North Eastern Electricity Board, retires on 31 Mar., after 43 years in the Supply Industry. Previously to vesting day he was Borough Electrical Engineer at West Hartlepool, to which position he was appointed in 1931. Mr Tillotson began his career with the Cleveland and Durham Electric Power Co. in 1910 and after serving in the R.N.A.S. during the 1914/18 War he joined the West Hartlepool County Borough electricity supply undertaking. In 1926/7 he held the position of consumers engineer with the Birkenhead Corporation undertaking, returning in the latter year to West Hartlepool as mains superintendent, following which he was appointed to the senior position

Mr D. H. Ray

Mr S. R. Eade



Mr R. M. Campbell

Mr R. E. G. Durham

Mr S. Tillotson

as already stated. Mr Tillotson was a member of the Council of the Incorporated Municipal Electrical Association and for many years secretary of the North East England Centre. He also acted as secretary of the A.M.E.E., North East England Centre, and was a member of that body. He is a past chairman of the former Northern Counties Area Committee of the E.D.A., of which committee he was a member for almost 20 years, serving also on the National Council of the Association. Mr Tillotson is present chairman of the Tees-side Committee of the E.I.B.A.

The Minister of Fuel and Power has re-appointed **Alderman A. Sturgess,** O.B.E., J.P., of Derby, as a part-time member of the East Midlands Electricity Board. The Minister has also appointed **Mr Tristram Beresford** as a part-time member of the South Western Electricity Board with effect from 1 Apr., in place of **Mr G. H. Johnstone,** O.B.E., D.L., who retires on 31 Mar. on completion of his term of office. Mr Beresford is at present deputy chairman of the South Western Electricity Consultative Council but will cease to be a member of that body on 31 Mar. The Minister has also re-appointed **Mr H. M. Medland** as a part-time member of that Board.

Pye Telecommunications announce the appointment of **Mr F. H. Foster,** as area sales manager for Derbyshire, Nottinghamshire, Lincoln and Lindsey and Sheffield. He will be operating from Sheffield, his address being 348, St James's Chambers, 56, Church St.

Mr I. Shoenberg, M.I.E.E., has been elected to the board of Electric and Musical Industries Ltd. He has been closely associated with television development for more than a quarter of a century, and was last year awarded the the Faraday Medal by the Council of the I.E.E.

Mr J. L. Wilkie has been appointed commercial director of Radio Rentals. He has resigned as secretary and **Mr A. O. B. Wall** has been appointed to succeed him.

Due to retire on 28 Mar. is **Mr H. P. Hainsworth,** M.I.E.E., district engineer at Bridlington to the Yorkshire Electricity Board. Prior to vesting day he was chief engineer with the Bridlington Corporation electricity undertaking, with which he had served since 1917. Previous to that he had gained experience with Leeds Electricity Department, Siemens Bros., Vulcan Motor Engineering Co., Paisley Electricity Department and with British Ropes Ltd.

Manager of the Sheffield office of the Metropolitan-Vickers Electrical Co., Ltd., since 1947, **Mr R. P. Horlock,** B.SC., A.C.G.I., M.I.E.E., has transferred to the Metropolitan-Vickers Electrical Export Co., and is now manager for Canada. Now manager of the M.-V. Sheffield office is **Mr R. S. D. Bagnall,** D.F.H., M.I.E.E., M.AMER.I.E.E. Mr Horlock went

Mr R. P. Horlock

Mr R. S. D. Bagnall

Mr R. H. Gummer

to M.-V. as a college apprentice in 1928 and subsequently joined the rolling mill section of Plant Engineering Department. After a short period in the company's London office and further work in Plant Department, he was appointed manager, Leeds sub-office in 1941, becoming manager of the Sheffield office in 1947. Mr Horlock served for 12 years on the committee of the North Midland Centre of the I.E.E., and was chairman in 1948-49. Mr Bagnall was also a college apprentice with M.-V., and following a period in Motor Engineering Dept., joined the Bombay office of A.E.I. (India) in 1938. From 1941 he was with the Admiralty, first in Ceylon and subsequently under the Dockyard Directorate at Bath. After the war he joined the Brush Electrical Engineering Co., being London office manager from 1947 to 1952, and later becoming a member of the local board of directors at Loughborough. On resigning that position he was appointed manager, M.-V. Sheffield office.

As a consequence of the expanding activities of the English Electric Co.'s Domestic Appliance and Television Division, the demonstration team is being increased and re-organised. Two new appointments are announced and others will be made in the near future. Overall control of the team remains with **Mrs May Pearce,** but responsibility for day to day administration of the team's work will be in the hands of two senior demonstrators. **Mrs K. Bellamy,** who has been with the company since 1950 as senior demonstrator, will take charge of Southern, South Eastern and South Western England, South Wales and the Midland and East Midland areas. **Mrs G. Rawlinson** joins the company as senior demonstrator based in the Leeds office, and will have charge in Northern England, responsible for the demonstrators working in Yorkshire, the North West, the North East and on Merseyside. Mrs G. Rawlinson completed her domestic science training at Worcester Technical College. She holds the E.A.W. Housecraft Diploma with first class distinctions in cookery and salesmanship and a first class pass in home laundry. In 1938, Mrs Rawlinson was appointed assistant demonstrator with the Scarborough electricity undertaking, and from there was promoted demonstrator in Barnstaple, senior demonstrator in Worcester, and to housecraft adviser with the Midland Electricity Board at Wolverhampton. She has worked as area supervisor of school meals in Nottingham and catering officer at Birmingham Children's Hospital. **Miss A. W. Hicks** who joins "English Electric" as a demonstrator for the London area, trained at Queen Mary College, Lytham. She holds the I.M.A. Certificate and the E.A.W. Electrical Certificate. In 1952 Miss Hicks was appointed to the Eastern Electricity Board as a demonstrator in Ipswich, transferring a year later to the Fulham Sub-Area, where she continued to work until her present employment.

Elected president of the Institute of Fuel is **Mr R. H. Gummer,** M.I.MECH.E., F.INST.F., who retired from International Combustion (Holdings) Ltd., last April, but remains a director of that company. Mr Gummer will take office in Oct. next, succeeding **Dr W. Idris Jones.** Mr Gummer, who was with International Combustion for nearly thirty years, is consequently very well known throughout the boilermaking and fuel industries. He has been largely concerned in the considerable expansion of the activities of International Combustion, including the launching of new foundries and engineering shops in South Africa.

Formerly district installation engineer in the Swindon office of the Southern Electricity Board, **Mr E. C. Hallam** has taken up an appointment as commercial assistant and branch manager at Hebden Bridge, with the Yorkshire Electricity Board.

OBITUARY

Mr J. Boon, station superintendent at Gt Yarmouth power station, Eastern Division, B.E.A., died on 8 Feb., aged 53. Mr Boon commenced his service in the Industry with the Ipswich Corporation Electricity Department as an apprentice in 1917 and had been station superintendent at Gt Yarmouth since 1949. He had been chairman of the East Anglian section of the E.P.E.A.

Mr I. T. L. Whipp, M.I.E.E., a director of Whipp and Bourne Ltd., died on 8 Feb., after a shooting accident in Ireland.

Mr M. E. F. Crealock, deputy chairman of Hick Hargreaves and Co., has died.

Mr C. T. Powell, O.B.E., joint managing director of Partridge Jones and John Paton Ltd., died on 12 Feb., aged 62.

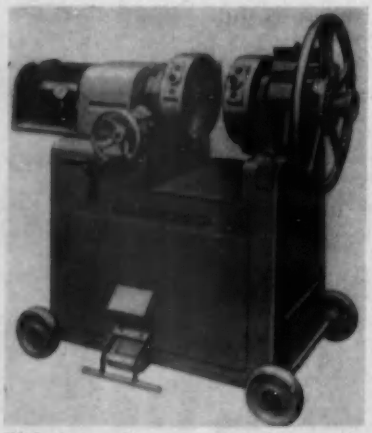
Equipment for Industry

Sealing Rope Ends

THERE is a tendency for the ends of wire ropes to be fusion-sealed rather than bound, the advantages being that, treated in this way, they are easier to thread and safer to handle. Fusion sealing is effected by securing the end of the rope between two clamps which are connected to the secondary of a transformer. By operating a foot switch the transformer is energised and current flowing in the wire rope increases its temperature. By adjusting the amount of heat and applying tension to the rope, the required tapering can be achieved, and the rope eventually burns through.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, have been manufacturing a machine for some time but have recently redesigned it so that the tension is applied hydraulically instead of manually. With this machine as an alternative to sealing the ends of the rope, individual strands may be sealed, so that the rope is then suitable for splicing.

A 25 kVA oil-cooled transformer supplies the power for heating, control being effected by means of a foot-switch operated contactor. Ropes from ¼ in. up to 1 in. diameter may be accommodated, and occasionally the machine may be used with 1¼ in diameter cables. The time taken for parting operations varies from 50 sec. to 2 min. according to size.



With this machine ropes up to 1¼in. may be either fusion-sealed or parted

Hermetically-sealed Instruments

FOR some years now various government departments have been calling for a series of hermetically-sealed instruments and the result has been that many firms are now in a position to supply such equipment for industrial purposes. In conditions of high humidity or dusty atmospheres these products are of particular use and are now being employed in such applications as chemical plants and boiler houses. RECORD ELECTRICAL CO., LTD., Broadheath, Altrincham, Cheshire, are producing a wide range of these instruments which are all housed within diecast cases of silicon aluminium. To ensure that the sealing is adequate all instruments, prior to despatch, are tested by immersion in water for a minimum period of 30 minutes, with the temperature decreasing from 60° C to a final value of 30° C.

Moving iron and moving coil instruments are made in addition to "Cirscale" tachometers, wattmeters and power-factor meters. Flush-fitting or projecting types are available and all instruments are finished in a fungus-resisting enamel.

Long Life Soldering Bit

UNDOUBTEDLY one of the main troubles experienced with soldering irons is due to time lost in constantly preparing the copper bit to make it suitable for clean working. LIGHT SOLDERING DEVELOPMENTS LTD., 106 George St, Croydon, Surrey, have introduced the "Permabit," a specially developed alloy bit, which is claimed to have overcome this difficulty since it is said only to require wiping with a rag to maintain it in clean condition. Its use, therefore, obviates the necessity for constant filing, the case with copper.

Due to the characteristics of the alloy, it is unsuitable for certain types of work to be undertaken, but it is finding wide application in the radio and electronic fields. "Litesold" irons are made in four standard sizes having bits with diameters ranging from ⅛ in. to ½ in. Spare bit element units incorporating the "Permabit" make it possible to convert existing irons to take advantage of this new product.

Standardised Contact Metals

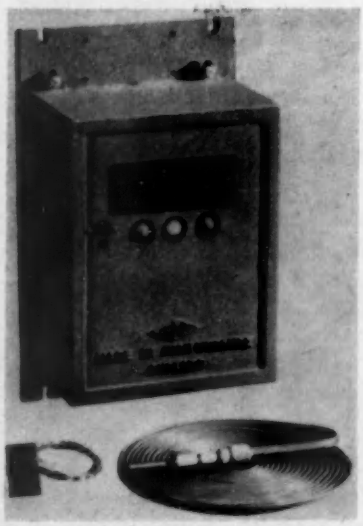
TO meet the widely varying properties required of the contact metals, METRO CUTANIT LTD., Grappenhall, Warrington, Lancs, have been manufacturing a range for some time, and recently they have standardised on seven different types which are contained in the "Elmet" range. The properties of contact metals have been reduced to five principal divisions, density, hardness, conductivity, both electrical and thermal, and melting point. By varying the compositions, the firm have produced a range which is said to achieve the hardness and electrical conductivity requirements with widely varying melting points.

Two techniques have been developed for attaching contact tips, the first is by means of normal brazing and the second employs a vacuum casting technique. With the latter, a more intimate bond between the metals is said to be achieved, which has particular advantages for high tension switchgear where maximum efficiency is essential.

Accurate Temperature Control

FOR applications where close control of temperature is required, a new instrument manufactured by AIRMEC LTD., High Wycombe, Bucks, could be employed. The detector takes the form of either a flat mica resistance mounted close to the oven or room whose temperature is to remain constant, or a sealed platinum bulb thermometer. The latter being used for liquids or in damp or corrosive atmospheres

The resistance element forms one arm of a bridge circuit, another arm of which is made variable to provide the adjustment of temperature. Out-of-balance voltage on the bridge is amplified and used to operate two separate relays. These are arranged so that they are sensitive to slightly different temperatures. This difference being adjustable between 0 and 3° C. The unit is particularly suitable for control of processes using motor operated valves and operates on temperatures ranging from −96° C to 428° C when using the thermometer detector and otherwise from −46° C to 300° C. Sensitivity is such that the relays operate on changes of control resistance of the order of 0·1%. This is said to represent a temperature change of 0·25° C for the mica resistance element and 0·4° C for the platinum bulb thermometer at 100°C. Each of the relays is rated at 5A, 230 V heavy duty changeover contacts being fitted. The unit measures 8 in. wide by 13 in. deep and projects 5 in. Weight is 13 lb.



Close control of temperatures over a wide range is guaranteed for this instrument

Siemens introduce Sentinel Fencing Equipment

LATEST firm to enter the electric fencing market is SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., 38-39 Upper Thames St, E.C.4, who have introduced their "Sentinel" equipment.

The basic equipment consists of a pulsing unit, a battery box and an earthing post supporting these components. Accessories available are additional fencing posts and insulators.

The voltage generated on the fencing wire is approximately 1,200 V derived

Siemens "Sentinel" is miniature unit

from four Siemens BS or O type 1½ V dry batteries. This is applied to the fence for 12 milliseconds only at an average rate of 46 times a minute. When the battery is unable to correctly pulse the unit the apparatus stops working so it cannot under any circumstances produce the continuous high voltage charge sometimes encountered in electric fencers.

One set of batteries will provide continuous running in excess of three months permitting the fencer to operate in all climatic conditions. There are only two moving elements—the armature and the contact springs and the Siemens P.O. type relay used is highly tropicalised. All leads to the pulsing unit enter through special watertight glands. The posts have three position insulators for use according to stock enfolded and the fencer unit is designed in such a robust manner as to withstand the weight of a tractor. Smallest unit on the market the "Sentinel" costs £9. 5s. Extras include battery box, batteries, earthing post, fencing posts and insulators.

New Friedland Accessories

AN illuminated bell push, and a new range of bell transformers have been announced by V. AND E. FRIEDLAND LTD., Lower Heys Mill, Macclesfield, Cheshire.

The "Pushlite" combines an illuminated bell push button with a light beam concentrated on the keyhole. It also provides a small panel for the name of the occupant. Made in fluted bronze Diakon, the "Pushlite" can be used on any transformer operated bell or chime circuit. No new wiring is required. It is packed in an attractive cellophane window carton and retails at 7s. 6d.

The new range of bell transformers provide an easily wired unit fused, with its fuses in a safe and accessible place. Prices have been substantially reduced, for example, the B.74 transformer for normal bells is available at a retail price of 12s. 6d. whilst the C.75 transformer suitable for chimes costs 15s. 6d.

Radio Reception for the Deaf

THE disability of deafness has to a large extent today been ameliorated by the development of efficient deaf aids but even so the sufferer receives sound to put it frankly "second hand" so that any defect in the microphone or other components of the hearing aid will distort reproduction.

When listening to radio and television sound broadcasting this hazard increases making for, in many cases, great discomfort to the wearer, through maladjustment of the volume and tone controls both of the radio or TV receiver and the deaf aid.

The "Rai-Tel-Ade' produced by ELECTRIC ADES, Orchard Hse, Sunbury-on-Thames, Middlesex, is designed to overcome these troubles Housed in a neat casing 3 in. x 4½ in., finished silver grey, this instrument plugs into the output circuit of the radio or TV receiver and receives the signals, which actuate the loud-

Reception straight from the set is possible with this unit

speaker, then converting them into sound which the deaf person may then receive directly from a miniature insert ear piece of the conventional hearing aid style. Ambient noises are eliminated and the user has a personal volume control and tone control on the instrument itself.

Tested to withstand 2,000 V d.c. and guaranteed for two years with maintenance costs nil, the "Rai-Tel-Ade" is sold complete with plug and socket, lead and insert type receiver which accepts the personal ear mould at £4. 15s.

G.E.C. Warming Plate has Removable Glass Top

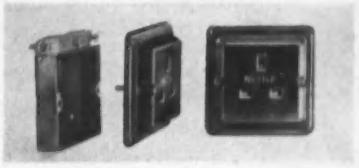
ONE feature of a new electric warming plate introduced by the GENERAL ELECTRIC CO., LTD., Magnet Hse, Kingsway, W.C.2, for keeping cooked dishes hot is a heat-resisting, non-scratch, glass top that can easily be removed for cleaning. It is held in position by two studs. To keep dishes really piping hot the loading has been increased on this new model to 250 W but to ensure that the warming plate will not overheat the table surface a sheet of asbestos has been placed immediately under the elements. The rolled sides of the warming plate are finished in chromium plate and the end brackets and feet are of heat resisting black Bakelite material. The heated surface measures 18 in. x 10 in. and the warming plate (D5676), supplied complete costs £7. 10s.

Feature of this new warming plate is the glass top which lifts off for easy cleaning

For the Electrical Trade

Extended 13 amp range from Nettle

FURTHER extension to the range of 13 amp ring main accessories by NETTLE ACCESSORIES LTD., Harper Rd, Wytheshawe, Manchester, takes the form of a semi-recessed switch socket which can be used in conjunction with standard shallow lug fixing switch boxes.



This switch-socket is a new line

The socket and plate is already assembled into a complete unit and is fixed by only two screws. Boxes are available in terminal and through types with two entries adjustable grip. They are available in brown, cream and in the new ivory finish recently introduced.

List price of these units complete with plugs in brown is 88s. per dozen, in cream and ivory 99s. 8d. per dozen.

NEWS OF THE WEEK

Registration for Contractors

Agreement reached on National Inspection Council

AGREEMENT on the setting up of a National Inspection Council for Electrical Installation Contracting has been reached at last. The Organising Committee which has been striving for a generally acceptable basis for such a council since 1948 made this announcement early this week. Organisations sponsoring the Council will include those represented on the organising committee, that is the I.E.E., the B.E.A. and the area boards, the E.C.A. and the E.C.A. of Scotland, the N.R.E.I.C., and the Employees' National Committee of the Electricity Supply Industry, as represented by the E.P.E.A. and the E.T.U.

Four objects are laid down for the Council. It will keep a roll of approved electrical installation contractors covering Great Britain and Northern Ireland, the Channel Islands, the Isle of Man and Eire. Approved contractors will have to furnish evidence of their competency and to comply with the rules and regulations of the Council. Certificates are to be granted to approved contractors, and withdrawn where the necessary standards are not maintained. Further, the Council is to organise the inspection of electrical installation work in Great Britain and Northern Ireland, to determine whether the work conforms with its requirements as to workmanship, safety and general standards. Finally, the Council is to encourage improved methods of protecting consumers of electricity against faulty or unsafe electrical installations and appliances, and to bring to the notice of the public matters concerned with the safety, standardisation, development and improvement of electrical installations.

Voluntary registration of contractors, in the general form now adopted has been under discussion since the nationalisation of the supply industry in 1948. In the "Statement of Principles" covering electrical contracting and retailing, agreed by the B.E.A., area boards and electrical contractors' associations in 1949, there was recognition that an Inspection Council should be set up. At first negotiations went well, but later difficulties of principle were met.

E.W.F. Change Venue

A SLIGHT alteration has been made in arrangements for the annual meeting and dinner of the Electrical Wholesalers' Federation. The annual meeting will take place on 17 Mar. at the Dorchester Hotel, Park Lane, and not at the Waldorf Hotel as previously announced. The dinner in the evening will be at the Dorchester as arranged, and Sir W. Wavell Wakefield will be principal guest.

New Works to cope with Traction Demand

NEW premises at Dudley Port, Staffs., has been purchased by the General Electric Co. to augment its manufacturing facilities for electric traction. The factory will provide an additional 100,000 sq ft of space and will be devoted exclusively to the manufacture of motors, generators and auxiliary machines for electric and diesel-electric locomotives and rolling stock. This acquisition will, of course, enable the company to play its part in meeting the big demand which can be expected following the scheduled development of British Railways over the next 12 years. The factory is situated within easy reach of Witton, Birmingham, from which it will be controlled, and is expected to be in full production within a year.

Thermionic Valve History

LECTURES delivered at the golden jubilee celebrations of the thermionic valve are to be published in book form in the spring by the I.E.E. The celebration took place on 16 Nov. last and lectures were by Sir Edward Appleton, Prof G. W. O. Howe and Dr J. Thomson. These talks, as well as the opening address by the Marquess of Salisbury, an appreciation of Sir Ambrose Fleming and Lee de Forest by Capt C. F. Booth, and complete list of exhibits will form the contents. The book will be in semi-stiff covers, and be priced at 4s. for members and 9s. for non-members. Supplies will be limited so that orders should be made immediately to the Institution's secretary at Savoy Place, W.C.2.

REDUCED CHARGES FOR N.W. INDUSTRIALISTS

TARIFF concessions for some 3,500 large industrial and commercial firms in their area were announced by the N. Western Electricity Board on Monday. The decision follows the revision of the B.E.A.'s bulk supply tariff to Area Boards, and the benefits gained in this area are to be passed on to consumers. The revision includes a reduction in the fuel cost adjustment rate of ·00005d. per unit per 1d. variation in fuel cost per ton. A similar reduction has been made in the Board's fuel cost adjustment rates of their standard industrial tariffs and of supplies under Agreement. Their concession will begin on 1 April and is estimated to benefit consumers to the extent of about £61,000 a year.

Eastern Board decide their Industrial Tariff

TERMS of the Eastern Electricity Board's new maximum demand tariff which is to come into force on 1 Apr. were announced last Monday. The tariff applies, in the main, to industrial consumers, who from that date will pay 6d. a month more than under the present tariff for each kW or kVA of maximum demand. The cost of fuel adjustment figures will be less than before, however, because of a similar reduction to the Board in the terms on which they buy their bulk supply from B.E.A. Details of the B.E.A.'s new terms may be found on page 259. It will be recalled that the Eastern Board gave details of their revised domestic, combined premises, farms and block tariffs last month, but a decision on the maximum demand charges was delayed pending receipt of the B.E.A.'s charges for bulk supply. The Board calculates that this latest amendment will mean only a small alteration within the range of 3% increase to ¼% decrease in the total bills of affected consumers.

NEW BOARD CAN BORROW MONEY NOW

REGULATIONS concerning the borrowing powers of the South of Scotland Electricity Board have been made and come into operation on 21 Jan. They allow the Board, with the consent of the Secretary of State and the approval of the Treasury, to borrow temporarily for their administrative and preliminary expenses up to the end of next month. The Board begins operation on 1 Apr.

First Dounreay Contract

THE U.K. Atomic Energy Authority has let a contract for the civil engineering and building of the atomic power station at Dounreay. It has been placed with the Glasgow firm of Whatlings Ltd. Work is to begin at once, it is reported.

Switzerland is Valuable Long-Term Market

DESPITE its highly competitive nature, the Swiss market must remain one of the most valuable that any U.K. exporter, who is prepared to take a long view, can cultivate. This is one of the main conclusions reached in the Overseas Economic Survey of Switzerland published last week. The report states that after many years of prosperity a serious recession would be considered contrary to the order of nature, but in any case the country would probably weather the storm better than most.

Although this high commendation is made it is difficult to find in the survey any direct substantiation where the electrical industry is concerned. Electrical consumer goods are hardly mentioned, and the recorded progress of engineering industries does nothing to suggest an easy market, in fact, quite the reverse. One significant reference to domestic appliances gives a fair indication of prospects, however. Between 1950 and 1952 the number of cookers rose by 14% to 495,000, water heaters by the same amount to 482,000, small household motors by 28% to 480,000, and refrigerators by 39% to 116,000.

On the Swiss supply industry it is said that water-power was being exploited rapidly. In October, 1953, 14 hydro-electric power stations, each of 10 million kWh capacity at least, were being built. By 1961 total investment in electricity generation is expected to reach Sw.Frs. 7,500 m. The cost of new installation is rising but charges to consumers are stable.

Essay Competition for Research Scientists

FOR the third successive year the Science in Industry essay competition is being organised by the scientific advisory board of *Research*. Its purpose is to encourage scientists to present the problems of their research work in more intelligible form to less highly qualified persons. The contest will be in two parts. The first is designed to draw attention to the problem of the scientist in communicating with the industrial policy-maker. Competitors are required to make their case in an essay of about 3,000 words. Prize valued at £200 will be awarded in this part, and the author of the best essay will receive the new Waverley gold medal. The second part requires the competitor to discuss one of four set subjects in a manner suitable for publication in a national newspaper, and prizes in this instance amounting to £150 will be awarded by the *Sunday Times*. Total number of entries received last year was 107.

Prizes for Technical Articles on Radio

SIX premiums of 25 guineas each have been awarded by the Radio Industry Council for articles published during 1954. They will be presented to the successful authors at a luncheon to be held at the Cafe Royal, London, on 10 Mar.

Two premiums have been awarded for three articles on the Leo computor written by Messrs E. J. Kaye, J. M. M. Pinkerton, E. H. Lenaerts and G. R. Gibbs. Two articles on I.F. Amplifiers by Mr H. S. Jewitt won one premium, and similarly Mr A. E. Maine's two articles on High-Speed Magnetic Amplifiers also gained a 25 guineas prize. Single premiums were also awarded for articles on a Torquemeter for Testing Gas Turbine Components by Messrs J. F. Field and D. H. Towns, and on Dip-Soldered Chassis Production by Messrs W. R. Cass and R. M. Hadfield.

It is also announced that Prof H. M. Barlow of University College, has replaced Prof Willis Jackson on the panel of judges.

OFFICIAL PUBLICATIONS

BRITISH STANDARDS.

B.S.2567, 1955: Steel Roller Conveyors; B.S.2565, 1955: Drums for Winding Wires and Strips.

BORROWING REGULATIONS.

S. of Scotland Electricity Board (Temporary Borrowing) Regulations, 1955. H.M.S.O. 2d. (See page 290.)

Programme of Nuclear Power. Cmd. paper 9389. H.M.S.O. 9d. (See page 261.)

Midland Display of Welding Equipment

ON view all this week and next at the Midlands Boards' industrial showrooms at Aston is an exhibition of arc welding and fabrication equipment. Arranged in conjunction with Petbow Ltd., this is one more in the continual series of displays staged in these special showrooms. A comprehensive range of welding, cutting and manipulating equipment will be exhibited, from motor generator and transformer welding sets to electrodes and accessories. As usual, qualified staff will be present to answer queries, demonstrate equipment and deal with particular problems of visitors The exhibition closes on 25 Feb.

STAFF DINNER

SOCIAL highlight of Southern United Telephone Cables' year is their staff dinner and dance, which took place last Friday. Over 300 members and guests attended. Proposing the toast of the company, Mr J. G. Ellis, outside contracts dept., expressed his pleasure at hearing of their efforts in being ahead of schedule in manufacturing the 70 mile trans-Newfoundland section of the Atlantic telephone cable. Mr F. Waine, dep. chairman and chairman of C.M.A., replied.

Board Chairman promises Rural Supply if . . .

PROMISE of a full share of the S.W. Electricity Board's expenditure in the future in spite of the difficulties and heavy costs involved, provided farmers gave all the support needed, was made by the Board's chairman, Mr S. F. Steward, at the annual dinner of the Barnstaple branch of the N.F.U. He reminded his audience that they needed electricity to improve output and amenities but added that the Board depended on them to take the supply when it was available and use it to the best advantage.

Mr Steward explained that North Devon was one of the most sparsely populated areas in the Area and that was why it was left undeveloped prior to nationalisation. Nevertheless, £200,000 had been spent on the primary network to provide a backbone for rural extensions. He went on to say that both agriculture and electricity supply must be run on sound commercial lines. Neither should subsidise the other and neither could afford to provide a service at a loss indefinitely.

Contracting Specifications

SPEAKING in Bristol recently Mr R. A. Marryat, vice-president of E.C.A., said the Association was producing a set of specifications for fittings in small houses. This, he said, was to counter local authorities who tended to keep fixtures in new houses down to a minimum.

Teams of Ferranti and Powers-Samas engineers examine a Ferranti computor under construction, during a recent visit of Powers-Samas experts. From left to right are Mr B. W. Pollard, manager of Ferranti's computor dept. and Mr W. G. Welchman, in charge of computor project planning; Mr W. E. Johnson, Powers-Samas' director of research, and Maj E. J. Guttridge, of Vickers-Armstrong computor laboratory.

Sixteen Competitors for 1955 Public Speaking Prizes

HALF the area finals for this year's Public Speaking Competition, organised by the Electrical Development Association, have been held, and it is now known that there will be 16 competitors, eight men and eight women. Contests have still to take place in Yorkshire, N. Western, N. Eastern and the combined Scottish areas. As usual, the final competition will take place in London and the date provisionally fixed is 11 May. Since the contest started in 1949, the women's shield has been won twice by the N. Western and Yorkshire Boards. The S. Western are the only Electricity Board to have won the men's shield twice, with the Merseyside, Eastern, Western and S.E. Scotland Boards having held it once each.

To date this year four women's contests have been decided. "The Social Influence of Electricity" was the subject chosen by both Miss P. Jenkins (Southern) and Miss Jean Padfield (Eastern). Miss J. M. Hughes (Midlands) chose "Advertising", and Mrs L. Blease (Merseyside and N. Wales) chose "Lighting and Living". Similarly, four men's area finals have been concluded. "Lighting and Living" was the choice of subject by Mr R. G. Charlton (S. Western) and Mr K. D. Brown (Merseyside and N. Wales). "Advertising" was the choice of Mr C. J. White (S. Eastern), and Mr B. A. Ward (Eastern) chose to speak on "The Social Influence of Electricity".

Imports into Cyprus are Licence Free

AMENDMENTS to the Cyprus import regulations have abolished the need for import licences in respect of a wide range of goods. These include electric bulbs, batteries, heaters and domestic appliances, provided they are from Britain or the Dominions (except Canada), or from countries of the O.E.E.C.

I.C.I. to build Power Station

A POWER station is to be built by Imperial Chemical Industries Ltd. at Thornton in Lancashire. The plant will supply three of the company's large factories in the area and will comprise a boiler house, turbine room, transformers, cooling units, workshops, office blocks and amenity buildings. Plans are said to be well advanced and construction will take about three years.

Servicing Equipment not covered by Traffic Act

ELECTRICAL equipment for testing transformers and a tool chest are not goods within the meaning of the Road Traffic Act, North Walsham (Norfolk) magistrates ruled recently. A driver of a 15 cwt was summoned for allegedly exceeding the speed limit. The police contended that the van was travelling at between 45 and 50 m.p.h. and when stopped contained two boxes of electrical equipment, a tool chest and two suitcases of personal effects. The driver admitted exceeding 30 m.p.h. but maintained he was not carrying goods. Mr A. W. Eaves, defending, said the van was one of a fleet used for carrying equipment for testing transformers. He maintained that if the items were held to be goods, it meant that if he drove a van and carried his legal textbooks, he would have to get a goods licence. The driver had pleaded not guilty and the case was dismissed.

DOES S. WALES FACE INCREASE IN TARIFFS?

A POSSIBLE appeal by the S. Wales Electricity Consultative Council for a reduction in charges under the domestic tariff has been shelved. Last May the Council postponed their proposal until the financial results of the Board's workings during 1953-54 were known, but in view of the much smaller balance shown, compared with 1952-53, it was decided at last week's meeting not to press for the reduction. Accounts showed a net surplus of £193,000 compared with £356,000 a year earlier.

One member, Mr E. H. Hickery, said that in his opinion, far from seeking a reduction, the Area might have to face a future increase. It was hoped that such an increase could be avoided, but increased costs could not be overlooked.

Endowed Prizes in 1955

CLOSING date for the receipt of entries for the various endowed prizes offered this year by the Royal Society of Arts is 31 July. Three prizes are offered. The Howard prize of £50 will be awarded to the author of a treatise on some aspect of mechanical motive power, and the Fothergill prize of £20 will go to the author of an essay or model embodying a new idea for the prevention or suppression of fire. The third, the Benjamin Shaw prize of £20 will be awarded for any discovery or invention leading to greater industrial safety.

Cold Cathode Lighting in W. London Garage

THERE have been numerous unusual and attractive lighting installations at garages in recent months, and the latest example to reach us is no exception to an apparent trend in brightening the motorists' service centres. The premises of Perivale Motors Ltd., occupies a prominent position in Western Ave, and have been designed so that an extension of two of the barrels of the concrete roof extend to form a canopy above petrol and oil pumps. Cold cathode fluorescent lighting was chosen for this installation, and the underside of the barrels has been treated with Interlight plastic emulsion paint to improve reflection. Eight runs of three cold cathode tubes butted end to end have been mounted directly on the concrete. Inside, in the showroom, provision has been made for circular glazed skylights. Tubes in each barrel have been fitted in four groups of three lines, each line comprising two tubes. Span of the barrels is 35 ft and maximum height is 21 ft.

This effective scheme, which again typifies excellent co-operation between architect and illuminating engineer, was planned by the General Electric Co. in conjunction with the architects, Wallis, Gilbert and Partners. Under the canopy are 336 ft of intermediate tubing, and interior lighting is by 384 ft of new warm white tubing. Electrical contractors for the installation were Rashleigh Phipps and Co. Ltd., London, W.8.

Interior and exterior views of Perivale Motors' garage where a total of 720 ft of cold cathode tubing was installed below concrete barrels

Century of Aluminium to be Celebrated in June

A PROGRESS Exhibition featuring the development of aluminium will be held at the Festival Hall in London between 1 and 11 June. The display will serve to mark the centenary of this metal and to demonstrate its varied applications to industry. It was at the Paris Exposition of 1855 that Prof St. Claire Deville exhibited samples of the metal. First article to be made of aluminium was a rattle for the Emperor Napoleon III's child. Thirty-one years later two scientists simultaneously but independently patented the electrolytic process for extracting aluminium from its oxide. About 30,000 tons of pure aluminium are produced in Britain today and world production exceeds three million tons. It is worth noting too that the price has declined from £144,400 a ton to a present-day figure of £163 a ton.

The First Half-Century

A Parliamentary report has been issued giving the laws in force about smoke prevention in Austria, Belgium, France, Germany, Italy, Holland and the U.S. The order is not as large as it seems, for most of these countries have none, though the town authorities have usually the power directly or indirectly to prevent obvious and determined nuisance. In Saxe-Coburg there is a law, namely, that the owner of the offending chimney must abate the nuisance—at the expense of the man who makes the complaint. Outside Great Britain, the most stringent laws are to be found in the U.S., and the strictest of the states is Illinois, where, it is remarked, Chicago is more smoke polluted than almost any other city on the American Continent. As Chicago is as wind-swept as Homeric Troy this is not very encouraging. Perhaps Sir William Richmond, now that he has finished the invisible mosaics in St. Paul's, might be persuaded to go and see what the Chicago smoke wreaths look like, and incidentally preach the gospel of smoke prevention there.—*From our issue of 16th Feb.*, 1905.

B.N.E. Ideal Home Contest Expanded

FOLLOWING the success of their competitions in the past two years, British National Electric are again staging a nationwide contest to coincide with the Ideal Home Exhibition. Success however has prompted the offer of more prizes and an extension of the scope of the competition. A C.90 cooker will be given to the successful entrant in each of four specified regions. A prize valued at £5 will also be given to winning youngster under 16 in each of the same areas. In the past, entrants have had to evaluate the selected selling features of the cooker, but this year they will be asked to place in order of merit five features of the C.90 cooker, B.N.E. water heaters and convector. The competition will open on 1 Mar. and close on 2 Apr.

FIVE-YEAR PLANS FOR SCRAPPING TRAMS

THE next five years will see the last of trams in Aberdeen and a considerable cut in the number of trams running in Glasgow if decisions taken in those cities last week are implemented according to planned schedules. The town council in Aberdeen unanimously approved a recommendation that their remaining tram services should be replaced by bus services. The change-over involves a capital expenditure of £406,000, of which £262,000 will be needed for additional buses. Main object of the switch from electricity to motor buses is to reduce the cost of running the transport department. It is calculated that in the first five years to 1960 there will be a saving of £92,674, and in the period to 1965 this sum would increase to £215,254. If trams were retained, it was estimated that the capital cost would be £552,350, comprising £380,000 for new trams and the remainder for repairing existing tracks. 62 new buses will be required. Trams first ran in Aberdeen in 1899 and buses were introduced in 1920.

The five-year programme being recommended by Glasgow's transport committee involves the scrapping of 300 obsolete trams. There are at present some 1,000 tramcars in the city. The department's general manager advocates the conversion of routes to trolleybus operation wherever feasible. He emphasises the implications of the conversion of Pinkston power station and sub-stations to 50-cycle standard frequency and the installation of a new turbo-alternator.

If the output from Pinkston should be seriously curtailed, he says, the cost per mile of electricity would rise to such an extent that the financial future not only of the remaining tramways but also of the trolleybus and underground systems would be jeopardised. His report, he notes, is framed on the assumption that an output of 40,000 kW from Pinkston should be maintained.

The report has now been remitted to a sub-committee for their consideration.

B.R. place Electrical Orders

THREE notable contracts for electrical equipment have been awarded recently by British Railways. Mechanical and electrical signalling equipment for the new marshalling yard at Thornton is to be supplied by Westinghouse Brake and Signal Co. Ltd. Automatic Telephone and Electric Co. Ltd., are to provide an automatic private branch telephone exchange for Glasgow, and finally, Hick, Hargreaves and Co. Ltd., will provide rotary air compressors for the St Rollox works in Glasgow.

London to have New North-South Tube

DETAILS were published recently of central London's first new underground railway for nearly 50 years. A Private Bill introduced to Parliament includes proposals for the first stage of the new Route C, which will run from Victoria, through Oxford Circus, Euston and King's Cross, out to Finsbury Park and beyond to Walthamstow, a distance of just over 11 miles. Apart from a short run at Walthamstow, it will be entirely in tunnel at depths of between 45 and 60 ft. The route was recommended originally by the London Plan Working Party set up in 1948 to study the capital's rail transport problems.

NEWS IN BRIEF

Course of five lectures on Corrosion and Protective Measures for Buried and Submerged Structures is to be given by Mr K. A. Spencer at Northampton Polytechnic, London, E.C.1, beginning on 7 Mar.

Industrial Welfare Society, 48 Bryanston Sq, London, W.1, are organising a course for training officers at Harrogate between 6 and 11 Mar.

A quota of 7,500 tons p.a. has been established for the import of black hot rolled copper wire rods from Canada and the U.S. in year from 1 Apr.

Over 200 were present at the annual social and dance of the North Essex district of the Eastern Electricity Board, held at Witham earlier this month.

Further to our note last week, Danfoss Manufacturing Co. are showing their film "Automatic Control for Heating Plants" at Film Hse, Wardour St, on 14 Mar. Tickets will be by invitation only.

In our reference last week to the electricity stand at the Scottish Dairy Show in Glasgow, the S.E. Scotland Board should of course have read S.West Scotland Board.

A new B.I.M. publication, Control of Stocks for Distribution, describes the practice of ten companies which took part in a study group organised by the British Institute of Management to exchange information on the subject. It costs 5s. The ten firms included Davis and Timmins Ltd., Griffin and Tatlock Ltd., and Philips Electrical Ltd.

Mechanical and electrical engineering departments of Brighton Technical College are to hold their prize distribution on 28 Feb.

Papers to be considered for the award of the Sir William J. Larke Medal of the Institute of Welding for 1955 should reach the secretary at 2 Buckingham Palace Gardens S.W.1, by 30 April, the Council of the Institute stated last week.

Eire's Electricity Supply Board inform us that Miss Neilli Mulcahy, one of the country's most promising young fashion designers, selected electrical terms as titles for models in her recently fashioned spring collection. An evening gown was called "Pyrotenax"; a sport's outfit, "Circuit-Breaker"; and one of the frocks, "Short Circuit."

Complaints, Suggestions and Replies in Yorkshire

Y.E.B. explain Why They seek Capital Contributions

A REPLY to allegations made by Adwick Urban Council on the Yorkshire Electricity Board's endeavours to provide sufficient power and lighting points in houses has been issued by the Board. The statement expresses the Board's view that provided adequate facilities were available to give all tenants freedom of choice, there would be such a substantial use of electricity that the schemes would become fully economic and produce sufficient revenue to cover the heavy initial capital expenditure. If, on the other hand, adequate facilities were not provided, and tenants were unable to make full use of services as they might desire, revenue received did not cover capital cost. The only course the Board could take was to ask the local authority to contribute towards capital expenditure.

This explanation followed the Board's request to Adwick Council that they should provide a complete power installation so that tenants could if they wished take full advantage of the supply. The alternatives which the Board sought were either a capital grant towards the cost of laying mains or a guaranteed revenue. The request was severely criticised by the council and described as "blackmail."

Plea for More Authority or Abolition

DOUBTS about the effectiveness of Consultative Councils were expressed by the Yorkshire Council's deputy chairman, Ald J. W. Holland last week. He maintained that if they were not given more authority they ought to be abolished. Explaining his contention, Ald Holland said that, assuming the council disagreed with the Board, they could go to the Central Authority, but the chairman of the Board was present there to receive the complaint. If the Council disagreed further, they could go to the Minister, but in practice they met permanent officials of the Ministry who were in day-to-day contact with the chairman. Consultative Councils were frustrated in their efforts to represent consumers, he said. Ald Holland concluded by saying that he hoped the Herbert Committee would either recommend more power for the Councils or recommend their abolition.

Unwired Rooms should not be Assessed

A RECOMMENDATION that domestic consumers should not be charged for unwired rooms was forwarded to the Yorkshire Board following last week's meeting of the Area's Consultative Council. The proposal follows Council's review of the standard domestic tariff introduced by the Board two years ago. They maintain it would be fairer if unwired rooms were not included in the assessment of property. The suggestion is aimed at old properties because new houses were wired throughout it was stated.

EDMUNDSONS' REUNION

DESPITE a suggestion last year that the annual reunion of the Edmundson Group should in future coincide with the Motor Show, the gathering will again take place on the last Friday in April. The suggestion was found to be impracticable. As a result the reunion will take place at the Horseshoe Hotel in Tottenham Court Rd, on 29 April. Reception will be at 6 p.m. and dinner at 7 p.m. Tickets, at 17s. 6d. each, may be obtained from either Mr F. T. Scribens, B.E.A. (Room 425) Winsley St, W.1, or Mr R. H. Sharman, B.E.A. (Room 212) Bankside Hse, Sumner St, S.E.1. Mr D. H. Kendon, chairman of the Merseyside and N. Wales Board, has accepted an invitation to be the 1955 chairman. Accommodation is limited to 170.

Higher Technological Education in London

RECENT proposals of the National Advisory Council for Higher Technological Education wholly satisfy none of the major interests in technical education. However, some compromise was necessary if anything was to be done at all. This opinion is expressed in the recently published sixth annual report year ending 31 Aug., 1954, of the London and Home Counties Regional Advisory Council for Higher Technological Education. After reviewing the recommendations of the 1944 Percy Committee, it concludes that "in spite of all the frustrations and disappointments of the past ten years we are, after all, a little nearer the goal." Detailed information on the wide range of the Council's activities given later in the report includes some notes on possible courses for electrical technicians, outside the national certificate scheme, and on the effects that changes in the regulations of the I.E.E. may have on Higher National Certificate Courses.

QUESTIONS IN PARLIAMENT

Purchase Tax

FURTHER anomalies in Purchase Tax arrangements were pointed out in the House last week, though none referred to electrical commodities. In the course of answers Mr H. Brooke said that the exemption of all goods on which the cost of living index was based from tax would cost about £200m a year.

Hire Purchase

CONCERN that recent increases in hire purchase would lead to inflation was expressed by Mr C. Osborne, who asked what steps were being taken to check the situation. Mr R. Maudling pointed out that extension of consumer credit could lead to increased production as well as increased consumption, so that it would be wrong to assume that the whole effect was inflationary. He said a close watch was being kept on that and other aspects of credit policy. Mr Osborne went on to state that H.P. interest rates exceeded 20% which put up the cost of goods, which in turn increased the cost of living. Mr Maudling again retorted that in so far as H.P. increased production it contributed to bringing down production costs.

Automatic Factories

THE subject of automatic factories was in the news again last week when Mr A. M. Skeffington asked what experiments D.S.I.R. were carrying out to create a fully automatic works. Mr J. R. Bevins said the National Physical Laboratory was conducting experimental work on electronic computors and on methods for the electronic control of machine tools. He added that the Department was keeping in touch with developments both at home and abroad, which prompted Mr. Skeffington to point out very considerable progress had been made by the U.S. Mr Bevins had scarcely assured his questioner that the work was certainly not under-rated, when Mr A. Woodburn pointed out that similar experiments were going ahead in Edinburgh with such success that in many cases we were ahead of the Americans, a fact which the latter admitted.

Pollution Measurements

SOME information on the work to date of measuring air pollution was given by Mr J. R. Bevins last week. He told Mr N. Dodds that measurements of pollution were being made daily by local authorities and others with the help of the Fuel Research Station. Preliminary results were published in a monthly bulletin issued to Government Depts., and local authorities. The help of C. D. volunteers was enlisted when severe fog was predicted but this has happened only once (16 Nov.). As the fog was dispersed quickly by rain it was impossible to obtain the desired scientific information.

Fuel Consumption in Schools

IN a written answer last week Sir D. Eccles stated that a building bulletin on heating of schools was being drafted. It would deal, among other things, he said, with fuel consumption in a sample of post-war schools.

Atomic Energy in N. Ireland

THE Minister of Works was asked by Lt-Col H. M. Hyde whether special consideration could be given to the estab-

lishment of an atomic energy station in N. Ireland. Lt-Col Hyde was told that N. Ireland would be considered along with other locations which satisfied technical requirements by the Atomic Energy Authority, but he pointed out the establishment of such a station was particularly important because N. Ireland had to import all her coal. The matter would certainly be borne in mind, the Minister said.

Railway Electrification

QUESTIONED by Mr S. J. McAdden, Mr J. A. Boyd-Carpenter said that planning and survey work on the proposed electrification of the Fenchurch St-Shoeburyness line was proceeding, and one major engineering work had already been authorised. The date of completion depended, among other things on the availability of equipment. Mr McAdden drew attention to the speed with which the Dutch electrified their railways—at a rate of 1km a day—but was reminded that the task in this country was very much greater than in Holland.

Street Lighting Standards

IN a written answer last week, Mr J. A. Boyd-Carpenter stated his department had advised lighting authorities to adopt standards recommended by the Departmental Committee on Street Lighting. Standards recommended for busy classified roads in built-up areas were such as would make the use of headlamps by motorists unnecessary he said. As regards safety on such roads, he told his questioner, Mr Page, that the risk of accident at night on those roads should be little, if any, greater than in daylight.

Fuel Research Station

ESTABLISHMENT and expenditure of the Fuel Research Station were subjects of a question by Mr F. T. Willey. The Minister of Works stated that the staff establishment of the Station during 1954-55 was 311 and the expenditure incurred, £295,550. These figures compared with 292 and £268,535 during 1953-54.

Industrial Efficiency

REPLYING to Mr F. T. Willey last week, Mr J. R. Bevins said the Committee on Individual Efficiency in Industry had so far sponsored twelve research projects. Work was progressing well and interim reports on same would be presented next month.

Use of Atomic Energy

ON 25 Feb. Mr R. Bell is to draw attention to the development of atomic energy for peaceful purposes, and move a resolution. This was one of three subjects successful in the Ballot for Notices of Motions announced last week.

Pedestrian Crossings

THE Minister of Transport told the House last week that at the end of last March there were 10,151 zebra crossings compared with 10,008 a year earlier.

ELECTRIC SUPPLY NEWS

Glamorgan

It is expected that the County Planning Committee's observation on the B.E.A.'s proposals to erect a new power station at the Leys, near Barry, will be submitted to the Minister of Fuel and Power next month. The B.E.A. have applied for planning consent for the station.

Loughborough

The B.E.A.'s Loughborough generating station, may be closed down at the end of next month. One of the authority's small stations, it has one 1·5 MW and one 3 MW Brush-Ljungstrom turbo-alternators installed. A final decision on its closure will not be made until the end of the B.E.A.'s financial year.

Northumberland

At the public inquiry into the proposal of the B.E.A. to construct a new power station at Cambois, the main question in discussion was the disposal of about 500,000 tons of ash annually. Five local authorities opposed a scheme for a pipe-line aqueduct to carry the ash out to sea—they favoured the method of dumping it from barges three miles out. But Bedlingtonshire U.D.C. preferred the pipeline proposal. The deputy town clerk of South Shields said they did not want the ash brought back by strong currents to their sandy beaches. The Tyneside River Board suggested the ash should be dumped four miles out rather than three. They feared that any polluted area would turn off salmon and sea trout making for spawning rivers. It could have a serious effect on the migratory running of the fish and would affect the livelihood of inshore fishermen. Presenting the B.E.A. case, Mr G. A. Thesiger, said from their point of view and that of the consumers it would be better to dispose of the ash through an aqueduct and put it straight into the sea. The inquiry was conducted by Mr H. W. Grimmitt, chief engineering inspector, Ministry of Fuel and Power.

Norfolk

As part of a large reinforcement scheme costing about £150,000 for North-West Norfolk, the Eastern Electricity Board are proposing to provide an additional feed from Snettisham to Docking via Bircham, which should reduce considerably the risk of failures in the Docking area.

Northern Ireland

In the Queen's Speech read in the Ulster Parliament last week, it was revealed that the Northern Ireland Government had approved the construction of a large generating station on a suitable site to be selected outside Belfast, and had under examination two schemes for hydro-electric development. No site has yet been fixed for the new steam power station, which it is assumed would be needed to meet the demands of industry before the construction of an atomic power plant could be considered. The speech added: "The highest importance is attached to the benefits that may result from the application of atomic energy to industrial uses and, in particular, to the generation of electricity. Arrangements have been made to ensure that full advantage can be taken of the developments now proceeding in Great Britain as soon as these reach a point where they may profitably be applied in Northern Ireland."

Londonderry Corporation also have under consideration the construction of a new power station, Councillor S. S. Dowds, mayor of Londonderry, stated in the Senate.

South Wales

Newcastle Emlyn Rural Council have decided that they are unable to approve the £40,000 Capel Evan rural development scheme of the South Wales Electricity Board as the Tanglwst area has been excluded from it. Approval was deferred until the Council's next meeting, although one councillor said he felt that in order to avoid delay on the other part of the scheme, the council should approve it as submitted by the Board and if their representations were successful, Tanglwst could then be included as the scheme proceeded.

Westmorland

Capital approval totalling a further £175,000 to cover further extensions in the Carlisle district, is anticipated by Mr J. E. Shepherd, No. 6 sub-area manager to the North-Western Electricity Board. He has assured the Border Rural Council that the Board was anxious to get rural areas electrified, and in two or three years' time would be dealing with the area in which the council was interested. He has also stated that if any consumer in the Border area could be supplied more economically from the Scottish side, they would take advantage of the Scottish Board's facilities.

LIGHTING SCHEMES

Banstead. A sub-committee has proposed a scheme for street lighting in the outlying areas, estimated to cost £37,000.

Chichester. T.C. has approved £2,350 scheme for lighting Kingsham Road, Basin Road and Canal Wharf.

Colchester. T.C. have approved in principle a scheme for improved street lighting, estimated to cost £84,900, involving conversion to sodium lighting of the whole of the borough except the main shopping streets which would have fluorescent lights.

Llandudno. M.o.T. has approved the Council's application for loan sanction for £8,688 in respect of the Craigydon section of the proposed improved street lighting scheme.

COMPANY ACTIVITIES

BIG news of the company world last week was G.E.C.'s plan to raise £10½m in loan and shares. Sir Harry Railing is well off the mark in what may be a race to raise fresh capital in the industry to meet the big rail and electrical development plans over the next 10 years. In the case of General Electric, shareholders are not given much information. The group's business continues to expand, they are told, and more funds are required to provide extensions, to meet the increased costs of modernisation and re-equipment of plant and buildings, and for capital working. The £10½m is to come from members of the company only. Preference and Ordinary stockholders and holders of the existing Loan Stock may subscribe for £6m of 4% Unsecured Loan Stock 1975-80 at a price of £97½%. There will be plenty of time to pay. Only £10 is required for application money and the final payment of £47½% is not due until July 15.

For Ordinary shareholders only, there is a rights issue of 1,959,240 £1 Ordinary shares at 48s. each on the basis of one new for each £6 of stock held on Jan. 20. At the time of the announcement the terms represented a bonus of about 1s. 6d. a share taking the price of the old shares at 59s. The dividend forecast is 12½%, which makes the G.E.C. yield 4¼%, which is higher than on either of the other two leaders.

Electric and Musical Industries have now announced terms of their new issue of Preference shares and Loan stock. Here again the whole of the issues are going to members of the company only. The Preference issue consists of 3m 5½% £1 Cumulative Second Preference Shares at 20s. 6d. each. The Note issue is for 2m Unsecured Loan Stock 1970-75 at par. Money is needed to finance the majority holding in Capitol Records of Hollywood.

For the third successive year, profits of L. Sterne and Co., refrigerator manufacturers, have declined. For the year to Oct., 1951, profits were over £91,000 and represented earnings of 104½%; for the year to Oct. last profits had fallen to £39,000 and the earnings on the Ordinary capital to 25·8%. A cover of nearly seven times for the 15% dividend has been reduced to about 1¾ times last time. Competition and rising costs, according to the chairman, have affected profit margins. Also during the past year the group was engaged in completely retooling its Hillington works, in order to manufacture the latest Tecumseh design of hermetic refrigeration compressors. Output was inevitably affected but as the tooling is virtually completed, and in some lines production has started on the new machines, there should be beneficial results from now onwards.

With competition less acute and some revival in new orders recently, the inference is that the past year is no criterion of the results to be expected in a year of normal activity. The chairman suggests that in general, company's prospects are as good as ever and that recent re-organisation should be beneficial. If that is so, the £1 shares at 41s., yielding nearly 7¾% are not over-valued.—*From our City Correspondent.*

Burco Ltd.

The chartered accountants have now reported upon the appropriate basis for the exchange of shares which would be involved in the proposed merger of Burco Ltd., and W. H. Dean and Son, Ltd. (to which we referred on Jan. 6). Messrs Peat, Marwick, Mitchell and Co. have expressed their opinion that after examination of the accounts of the two companies and all their subsidiary companies for the last ten financial years, a fair and reasonable basis of exchange of shares would be as follows: (*a*) For each 5½% Cumulative Preference share of £1 of W. H. Dean and Son Ltd., one 6% Cumulative Preference share of £1 of the new holding company; (*b*) For each Ordinary share of 5s. of W. H. Dean and Son, one Ordinary share of 5s. of the new holding company; and (*c*) For every four Ordinary shares of 5s. of Burco Ltd., five Ordinary shares of 5s. of the new holding company. The Boards of Burco Ltd. and W. H. Dean and Son have carefully examined these proposals and recommend them for acceptance by shareholders of both companies. Subject to the consent of the Treasury, it is hoped that a formal offer by the new holding company, together with forms of acceptance for the share exchanges will be posted to shareholders towards the end of March.

Sayings OF THE WEEK

"Humanity is potentially freed from mechanical, back-breaking tasks and mind-killing tasks by the development of electronic devices . . ." PROF. J. D. BERNAL, lecturing in Belfast.

"Every schoolgirl should be taught to mend a simple fuse so that later, as a housewife, she would be independent of her husband's aid . . ." Lord Mayor of Bradford, ALD. H. J. WHITE, addressing the local E.A.W. branch.

"Unless law or public opinion forbids it, producers will always be tempted to organise themselves into associations to agree prices, take things easy, and make a quiet profit without the sweating and striving which competition involves . . ." RALPH HARRIS, writing in the *Glasgow Herald*.

Cable and Wireless (Holding) Ltd.

The cost of investments quoted in Gt. Britain and abroad totalled £11,000,370 at the end of Dec. last. But the aggregate market price value of the investments amounts to nearly £17m. In addition there are unquoted investments of £3,334,045, which the directors are of the opinion are worth more than that figure, it is stated in the full accounts.

Electric and Musical Industries Ltd.

At the meeting last Friday, approval was given to the terms of Preference and Loan Stock issues, to finance the purchase of a majority holding in Capitol Records, as already noted. Ordinary and Preference stockholders and Noteholders are being offered: 3,000,000 5½% Cumulative Second Preference Shares of £1 each at 20s. 6d. per share, and £2,000,000 4½% Unsecured Loan Stock 1970/1975 at par.

General Electric Co. Ltd.

It is proposed to raise £10½ millions by internal issues of Loan stock and Ordinary shares. The Preference and Ordinary stockholders and holders of the existing Loan stock may subscribe for £6 millions of 4% Unsecured Loan Stock 1975-1980 at a price of 97½. For Ordinary stockholders only there is also a rights issue of 1,959,240 £1 Ordinary shares at 48s. each, on the basis of one share for £6 of stock held. In the notification of details to stockholders, Sir Harry Railing, chairman, explains that the directors have decided to raise more capital because the group's business continues to expand, and more funds are required to provide extensions, to meet the increased costs of modernisation and re-equipment.

M. Mole and Son

After allowing all charges, including taxation, the profit for the year ended 31 Dec. last is £19,189, compared with £18,457 a year earlier. The dividend is increased to 17½% (*15%*).

Skefko Ball Bearing Co.

Although the profit for 1954, at £363,277 (after taxation and other charges) is just slightly lower than for the previous year, the distribution is raised 1¾% to 21¼%, with a final dividend of 16¾%, tax free. Subject to the consent of the Capital Issues Committee, it is proposed to make a three-for-one scrip issue, but it is emphasised that the board does not at present contemplate a further increase in the Ordinary distribution in respect of 1955. At the meeting in April, proposals will be submitted for an increase in the authorised capital for £1½m to £5m, and the capitalisation of £2·7m of reserves for the scrip issue. Following this, the existing stock is to be converted into 5s. shares every four of which will then be consolidated into one share of £1.

Dividends Declared

H. J. Baldwin and Co. Interim of 10% (*same*).

Calcutta Tramways. Interim 3% tax free (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

19 Feb.—N. Ireland. Lamps for Hospital Management Committee in year from 1 Apr.—See 3 Feb. issue.

19 Feb.—Prudhoe U.D.C. Installation in 28 houses at Castle Dene.—See 10 Feb. issue.

19 Feb.—Stanley U.D.C. Group A 400 W mercury vapour lamps, lanterns and control gear, and concrete columns, for Bradford Rd, A650.—See 20 Jan. issue.

19 Feb.—Worsley U.D.C. Lamps in year from 1 Apr.—See 10 Feb. issue.

21 Feb.—Newark-on-Trent T.C. MV lamps on steel columns and filament lamps on concrete columns.—Advertised in 3 Feb. issue.

21 Feb.—Tynemouth T.C. Lamps and cable, columns, lanterns and fittings, and household accessories in year from 1 Apr.—See 27 Jan. issue.

22 Feb.—N. Ireland. Maintenance work for E. Antrim Hospital Committee in year from 1 Apr.—See 10 Feb. issue.

22 Feb.—Preston T.C. Installation at Ribbleton Hall school.—See 13 Jan. issue.

22 Feb.—Wellington (Som) U.D.C. Group A street lighting installation, sodium lamps on concrete columns along A.38.—See 10 Feb. issue.

23 Feb.—East Riding. Lamps in year from 1 Apr.—See 10 Feb. issue.

23 Feb.—Luton T.C. Installation at Beach Hill, Tennyson Rd and Maidenhall School canteens.—See 3 Feb. issue.

23 Feb.—Norwich T.C. Supply and erection of 36 group A concrete columns and 400 W mercury vapour lanterns, control gear, etc., for Colman Rd (A.1074). H. C. Rowley, City Engineer, City Hall. Deposit £2. 2s.

24 Feb.—Brigg U.D.C. Class A street lighting units on concrete columns and wall brackets.—Advertised in 3 Feb. issue.

24 Feb.—Charlton Kings U.D.C. Concrete columns, brackets with lanterns, etc., for class A sodium discharge lighting along London-Fishguard Rd.—See 10 Feb. issue.

24 Feb.—Co. Down. Installation at primary school at Scarva.—See 10 Feb. issue.

25 Feb.—Altrincham T.C. Supply of concrete lighting columns in year from 1 Apr. Borough Surveyor, Town Hall.

25 Feb.—Belfast T.C. Substation distribution board.—Advertised in 3 Feb. issue.

25 Feb.—Belfast T.C. Cables and flexible cords and blow-down pipework.—Advertised in 10 Feb. issue.

25 Feb.—Kidsgrove U.D.C. Concrete columns with mercury vapour discharge lamps, lanterns and accessories.—See 10 Feb. issue.

25 Feb.—Portslade-by-Sea U.D.C. Lighting installation along Fairfield Gdns.—See 10 Feb. issue.

25 Feb.—Co. Tyrone. Electrical installation at Strabane grammar school. Architects, McAlister and Tomlinson, 16 Waring St, Belfast, or 6 Market St, Omagh. Deposit £3.

26 Feb.—Dagenham T.C. Group A street lighting units in Ballards Rd.—See 3 Feb. issue.

26 Feb.—Exeter. Supply of electric lamps to all or any of 29 hospital groups under Exeter, Mid-Devon, E. Devon Management Committees. Joint Group Purchasing Officer, Royal Devon and Exeter Hospital.

26 Feb.—Irlam U.D.C. Lamps in year from 1 Apr.—See 3 Feb. issue.

26 Feb.—North Riding. Supply of electric lamps to children's and old people's homes in year from 1 Apr. County Welfare Officer, County Hall, Northallerton.

26 Feb.—Shoreham-by-Sea U.D.C. Supply and erection of group A street lighting with 140 W sodium units on concrete columns along two miles of Upper Shoreham Rd. Engineer and Surveyor, 31 John St. Deposit £3. 3s.

26 Feb.—Stockport T.C. Laboratory equipment for Stockport College.—See 20 Jan. issue.

26 Feb.—Weston-super-Mare. Supply of electric lamps in year from 1 Apr. for eight hospitals under Management Committee. L. B. Hull, secretary, Royal W. of England Convalescent Hospital, Uphill Rd.

28 Feb.—Basingstoke (Hants). Supply of electric lamps in year from 1 Apr. for Park Prewett Hospital. Secretary of Group Management Committee, F. Hales.

28 Feb.—Blackpool T.C. Group A and B street lighting equipment.—Advertised in 10 Feb. issue.

28 Feb.—Dewsbury T.C. Street lighting equipment.—Advertised in 27 Jan. issue.

28 Feb.—Friern Barnet U.D.C. Metal filament and mercury vapour lamps and sodium vapour lamps and jackets.—Advertised in 10 Feb. issue.

28 Feb.—Harrogate T.C. Lamps in year from 1 Apr.—See 3 Feb. issue.

28 Feb.—Co. Kildare. Rewiring of hospital at Naas.—See 27 Jan. issue.

28 Feb.—Manchester T.C. Installation in 108 dwellings at Beswick.—Advertised in 10 Feb. issue.

28 Feb.—Southampton T.C. Installation in Ludlow Rd infants' school.—Advertised in 10 Feb. issue.

28 Feb.—Westhoughton U.D.C. Lamps in year from 1 Apr.—See 3 Feb. issue.

1 Mar.—Widnes T.C. Materials in year from 1 Apr.—See 10 Feb. issue.

1 Mar.—Widnes T.C. Supply of electrical equipment for Highways Dept. in year from 1 Apr. J. Holt, Borough Engineer and Surveyor, Town Hall.—Advertised in this issue.

2 Mar.—Barrowford U.D.C. Electrical installation in 17 houses on Higher Causeway estate. Surveyor, Council Offices. Deposit £2. 2s.

2 Mar.—Fifeshire. Steel columns and brackets, sodium lanterns and ancillary gear for group A street lighting in Kincardine.—See 10 Feb. issue.

2 Mar.—Great Yarmouth T.C. Supply of electric cables in year from 1 Apr. Borough Engineer, Town Hall.—Advertised in this issue.

2 Mar.—N. Ireland. Installation for geriatric unit at Belfast City Hospital.—See 3 Feb. issue.

3 Mar.—Dublin. Electro hydraulic dockside capstans.—See 10 Feb. issue.

3 Mar.—Lancaster. Lamps in year from 1 Apr. for Lancaster Moor Hospital.—See 10 Feb. issue.

4 Mar.—Blackburn. Lamps in year from 1 Apr.—See 10 Feb. issue.

4 Mar.—Chatteris (Isle of Ely) U.D.C. Concrete and steel lighting columns, conversion from gas to electricity, and equipment for mercury vapour and tungsten lighting.—See 3 Feb. issue.

5 Mar.—Co. Mayo. Sewage pumping plant in Kiltimagh sewerage scheme.—See 20 Jan. issue.

5 Mar.—Longbenton U.D.C. Electrical installation in 30 houses at Forest Hall. A. E. Sweetman, Engineer and Surveyor, Council Offices, Forest Hall. Deposit £2. 2s.

7 Mar.—Andover T.C. Supply and erection of 672 concrete columns and equipment for sodium vapour discharge and fluorescent lighting. Borough Surveyor, Beech Hurst, Weyhill Rd. Deposit £2. 2s.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 128 queries answered this week

"Vitopan" pressure cookers, makers of? N.W.B.—Easiwork Ltd., 29 Goodge St, W.1.

"Celbatex" lagging jacket, makers of? T.E.—Kapok Ltd., North Acton Rd, N.W.10.

"L.G." meters, address for? R.B.—Landis and Gyr Ltd., Elgee Works, Victoria Rd, W.3.

"Barons" shades, makers of? N.W.B.—Barons Court Products, 126 Gt. Church Lane, W.6.

Domestic coffee mills, makers of? E.A. Zachariah Parkes Ltd., 47/48 Hampton St, Birmingham 19; Hillman Electric Motors Ltd., Northwold Rd, N.16; Sawtric Ltd., Honeypot Lane, Stanmore, Middx.

"Johnsons Allways Safelight" dark-room lamp, makers of? D.E.—Johnsons of Hendon Ltd., Hendon, N.W.4.

"Wi'ec" hairdryer, suppliers of? R.S.—Wilec Ltd., 90 City Rd, E.C.1.

Ringelman smoke density charts, suppliers of?—Chas Griffin and Co., Ltd., 42 Drury Lane, W.C.2.

7 Mar.—Buxton T.C. Group A mercury units on steel columns along A.6.—Advertised in 10 Feb. issue.
7 Mar.—Stepney B.C. Installation in blocks of flats in Sidney St.—Advertised in 3 Feb. issue.
8 Mar.—N. Ireland. Electrical supplies and lamps required in year from 1 Apr. by St. Luke's Hospital Management Committee, Armagh. Documents from secretary.
8 Mar.—Swanage U.D.C. Sodium lamps on concrete columns for groups A and B lighting.—See 10 Feb. issue.
9 Mar.—Dublin. Installation of electrical services at Grangegorman Mental Hospital. Varming and Mulcahy, consulting engineers, 70 Merrion Sq. Deposit £5. 5s.
9 Mar.—N. Ireland. Supply of lamps and fittings and electrical maintenance work in year from 1 Apr., at Coleraine, Rathbane and Mary Ranken Hospitals, Coleraine, and to Hopefield Hospital, Portrush. Secretary of Management Committee, Coleraine Hospital.
10 Mar.—Edinburgh T.C. Electrical installation at Duddingston primary school. Consultants, Ian Hunter and Partners, 46 Palmerston Place.
11 Mar.—Belfast T.C. Supply of 14 in. bore parallel slide valve for steam plant (specif. W.69), and bomb calorimeter and accessories (specif. W.70). Electricity Dept., East Bridge St.—Advertised in this issue.
11 Mar.—Southport T.C. Electrical installation in buildings at the Lido, Promenade, Ainsdale. Borough Architect, 99-105 Lord St. Deposit £1. 1s.
12 Mar.—Airdrie T.C. Lamps in year from 16 May.—See 3 Feb. issue.
14 Mar.—Cardiff T.C. Electrical installation in Llanrumney secondary modern school for girls. City Surveyor, City Hall. Deposit £2. 2s.
14 Mar.—Cheltenham T.C. Supply and erection of about 70 concrete columns and 140 W sodium discharge lamps, lanterns, etc., for London-Fishguard Rd, A.40. G. Gould Marsland, Borough Engineer, P.O. Box 12, Municipal Offices. Deposit £3. 3s.—Advertised in this issue.
14 Mar.—Grimsby. Electrical installation in old people's home in Littlecoats Rd. T. V. Oldfield, Borough Engineer and Architect, Municipal Offices, Town Hall Sq. Deposit £5.
22 Mar.—Leeds. Electrical installation at Westwood Hospital, Bradford. Apply to architect to Hospital Board, Park Parade, Harrogate, by 23 Feb. Deposit £2. 2s.
31 Mar.—Belfast T.C. Central evaporating plant.—Advertised in 27 Jan. issue.
6 Apr.—Wandsworth B.C. Concrete columns and ancillary gear for groups A and B street lighting.—Advertised in 10 Feb. issue.
7 Apr.—Belfast T.C. 3,300 V and 400 V switchgear and accessories. Also (closing date **24 Mar.**) extensions of coal handling plant.—Advertised in 10 Feb. issue.
No date stated.—N. of Scotland H.E. Board. 33 kV switchgear for Kintore substation.—Advertised in 10 Feb. issue.

Contracts Placed

Hendon T.C. Installation of street lamps for three years as from 1 Apr. next, General Electric Co., and Revo Electric Co.
Maidstone T.C. Wiring of 88 houses on Shepway estate, North Electrical and Refrigeration Co., Ltd., £1,969.
Scunthorpe T.C. Electrical work in 57 flats at Beechway. B. Pumfrey Ltd., £1,940.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 15 February

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	350	—	235
„ (3 months)	336	+4	216½
LEAD, refined pig, min. 99·97% purity (cash)	103	−1½	82½
„ (3 months)	103	−2	81½
TIN, refined, min. 99·75% purity (settlement)	713	−3	627½
„ (3 months)	715½	−4½	645
ALUMINIUM, ingots 99·99·5%	163	—	156
ZINC, virgin, min. 98% purity (cash)	90	−1	71½
„ (3 months)	87½	−½	70½
RUBBER No. 1, RSS, spot (per lb.)	30½d.	+⅛d.	16⅛d.
„ c.i.f. basis, ports, Apr. (per lb.)	30½d.	+⅛d.	16⅛d.
ARMOURING :			
Galv. Steel Wire (0·104 in.)	52½	—	51½
Mild Steel Tape (0·104 in.)	41½	—	40

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

4 Mar.—U.S.A. Supply of 1,000 kVA 3-phase, 12,500 step voltage regulators for Public Utility District 1 of Snohomish County, City of Everett, Washington, 3030 Colby Ave B.o.T. (Ref.: ESB 2484/55).*
8 Mar.—Pakistan. Supply of four 375 kW dual fuel generating set, switchgear, spare parts, etc. Director General, Supply and Development, Frere Rd, Karachi. B.o.T. (Ref.: ESB 2393/55).*
9 Mar.—Egypt. Mechanical and Electrical Dept. of Ministry of Public Works, Cairo, requires supply and erection of 7 transformer stations with switchgear, etc., to be connected with N. Delta h.t. transmission lines. B.o.T. (Ref.: ESB 2007/55).*
9 Mar.—South Africa. Supply of one 75 MVA, 200A, 6·6 kV, 3 unit switchboard. Tender No. C.8826. Stores Dept. of S. African Railways, Johannesburg. B.o.T. (Ref.: ESB 1943/55).*
10 Mar.—Egypt. Supply, erection of two pumpless mercury arc rectifier substations with switchgear, etc., for Cairo University. Ministry of Public Works, Mechanical and Electrical Dept., Stores Office, Cairo. B.o.T. (Ref.: ESB 1931/55).*
10 Mar.—Pakistan. Director General of Supply and Development, Frere Rd, Karachi, invites tenders (quote ref. Eng—X/3/32359/54/B) for supply 15, 30, 75, 300 and 400 kVA transformers. B.o.T. (Ref.: ESB 2395/55).*
10 Mar.—South Africa. Supply of considerable quantities of telephone cable of various descriptions for Stores Dept. of S. African Railways Johannesburg. Tender No. C. 8788. B.o.T. (Ref.: ESB 2743/55).*
12 Mar.—Iraq. Tenders (No. 85) invited for manufacture and supply of electrically operated pumping units and water treatment plant for Hindiya Water and Electricity Board. Deposit I.D.500. Directorate General of Municipalities, Baghdad. B.o.T. (Ref.: ESB 2053/55).*
15 Mar.—India. Supply of fuse cut-outs, automatic reclosers, shunt capacitors, oil circuit-breakers, and hand operated isolating switches. Documents from Director General, India Stores Dept., Govt. Building, Bromyard Ave, London, W.3, at Rs.10.
15 Mar.—Iraq. Directorate General of Municipalities, Baghdad, requires supply, erection of a 1,000 kVA step up transformer, six 100 kVA step down transformer and a l.v. switchboard, for Hilla Water and Electricity Board. Deposit I.D.500. B.o.T. (Ref.: ESB 2055/55).* Same Directorate also invites tenders for supply, erection of 1,000 kW generating set including control switchgear for Hilla power station. Deposit I.D.4,000. B.o.T. (Ref.: ESB 2054/55).*
16 Mar.—Egypt. Supply, erection of Rakaba Electric Irrigation-Pumping station and its transmission line for Ministry of Public Works' Mechanical and Electrical Dept., Projects Sections, Cairo. B.o.T. (Ref.: ESB 2008/55).*
16 Mar.—Pakistan. Supply of power station plant and overhead line equipment etc. for Gilgit hydro-electric project. Dept. of Supply and Development, Government of Pakistan, Frere Rd, Karachi. Tender No. Eng-X/34523/1/54. B.o.T. (Ref.: ESB 2557/55).*
17 Mar.—South Africa. Supply of 50 items of electrical signalling materials including signals and indicators, point machines, trade circuit equipment, block bells, transformers and accessories. Stores Dept., S. African Railways, Johannesburg. Tender No. C. 8903. B.o.T. (Ref.: ESB 2448/55).*
23 Mar.—Egypt. Tenders invited for supply, erection of h.v. transmission lines, feeding transformer station of pumping stations of Middle Egypt Electrification scheme and El Khiyam pumping stations. Director General, Mechanical and Electrical Dept., Ministry of Public Works, Cairo. B.o.T. (Ref.: ESB 2386/55).*
26 Mar.—Egypt. Factories Directorate of Min. of War in Cairo, require lighting fittings for workshops, offices, roads, etc., machine lamps, hand and desk lamps, lamp holders, switches, plugs and sockets. B.o.T. (Ref.: ESB 1824/55).*
31 Mar.—Tasmania. Supply etc. of electrically driven pumping plant for Hydro-Electric Commission of Tasmania. Specification C.E.489 available from Agent General for Tasmania, 457 Strand, W.C.2.—Advertised in this issue.
4 Apr.—Kuwait. Supply and erection of indoor HkV metalclad switchgear having ratings of 350 MVA and 500 MVA for substations. Dept. of Electricity, Govt. of Kuwait.—Advertised in this issue.
15 Apr.—Iceland. Electrical equipment wanted for hydraulic power station at Efra-Sog, and transformers and switchgear for extension of Irafoss hydro-electric power station and Elidaar transformer station. Offer issued by Sogsvirkjunin Rafmagnsveitz, Reykjavikur, Reykjavik. B.o.T. (Ref.: CRE 3468/54).*

BUSINESS PROSPECTS

Home

Ashford (Kent). New grammar school for boys costing about £110,000 to be built in playing fields of existing school.
Boston T.C. Construction of 76 houses and 24 bungalows at Wood Farm. Borough Engineer and Surveyor, Municipal Bldgs.
Burnley. Working drawings to be prepared for electrical installation at General Hospital.
Clutton (Bristol) R.D.C. Erection of 46 houses in district. Council's architects, Thomas and Morgan and Partners, 23 Gelliwastad Rd, Pontypridd.
Co. Antrim. It is proposed to build two intermediate schools at Lisburn and one each at Carrickfergus and Larkfield. Estimated cost £1,300,000.
East Ham T.C. Following have been approved: plans for 200 houses and flats, 8 shops, etc., on Canvey Island; redevelopment of Telham and Mountfield Rds to provide 180 dwellings; and next phase of same scheme comprising 48 flats.
Folkestone. Architects for proposed factory at Park Farm of East Kent Weavers Co. are Jackson and Jackson, 149 Sandgate Rd.

TRADE NOTES

New Branches. The Ransome and Marles Bearing Co. have opened a new branch office in Scotland and also moved to larger premises in Leeds. In Dundee, Angus, the new office at 310 Perth Road is under the control of Mr F. W. Austin. (Telephone Dundee 66155.) The branch office in Leeds is now at St. Paul's Hse, 20-22 St. Paul's Street, Leeds 1, where Mr J. R. Robertson is the manager. (Telephone Leeds 32094/5.)
New Phone No. The telephone number of Nettle Accessories Ltd., Harper Rd, Wythenshawe, Manchester, has been changed to Wythenshawe 4321 (4 lines).

Beama Contract Price Adjustment Formulæ.—*For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Feb., 1955, shall be deemed to be 150s. 6d.; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry published in the Board of Trade Journal on 12 Feb., 1955, is 173·4.

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Feb., 1955, shall be deemed at 150s. 6d. (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on 12 Feb., 1955, are: Materials used in Mechanical Engineering Industries—159·0; "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—146·9. The price of brass condenser tubes, ¾ in. o/d 18 s.w.g. published in *The Metal Bulletin* on 11 Feb., 1955, is 4s. 4½d. per lb.

For outstanding Contracts covered by the B.O.T. Intermediate Products Index. For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Feb., 1955, shall be deemed to be 150s. 6d.; (*b*) "Cost of Material"—the index figure for Intermediate Products published in the Board of Trade Journal on 12 Feb., is 372·6.

Glasgow T.C. Erection of 44 flats for old people in Northmuir Rd. Architectural and Planning Dept., 20 Trongate.
Great Yarmouth T.C. Application may soon be made to borrow £15(530 for erection of high school for girls
Jarrow (Dur.) T.C. Scheme for construction of blocks of flats and maisonnettes approved in principle. It is estimated to cost £860,000 and will eventually provide accommodation for 6,000. First stage comprises 391 dwellings for 1,303 people.
Kilmarnock T.C. Dean of Guild Court has approved plans for 48 houses on Robertson Place site and 50 at Bellfield. Cost estimated at £127,300.
London. Large building scheme in Farringdon St proposed by Amalgamated Press Ltd. Architects are Ellis, Clarke and Gallanagh, 58 Grosvenor St, W.1.
Luton T.C. Tenders to be invited for erection of further 150 houses on Runfold Ave estate.
Mexborough U.D.C. Erection of 106 dwellings on Highwoods estate. Architect and Surveyor, Council Offices, Adwick Rd.
Northumberland. Revised plans approved for old people's homes at Wallsend (£38,500) and Blyth (£37,500). It is proposed to build a C.D. training centre at Southgate, Morpeth, at cost of about £102,000.
Peterborough T.C. Construction of secondary modern school for girls on Dogsthorpe North estate. Surveyor, L. H. Robjohn, Education Offices, Town Hall.
Rothwell U.D.C. Construction of 30 houses on Wood Lane site. R. A. Eastdale and Son, architects, County Chambers, Bradley St, Castleford.
South Shields T.C. Sketch plans submitted for additions to Simonside county junior mixed school. Architects are T. A. Page, Son and Hill, 75 King St.
Swinton and Pendlebury T.C. Construction of 13 shops with maisonnettes in Rake Lane, Clifton. Borough Engineer and Surveyor, Town Hall, Swinton.
Tenbury Wells R.D.C. Erection of 42 houses at Tenbury Wells and 8 at Eardiston. Council's Architect, J. W. Greenwood, The Elms, Tedstone Wafre, Bromyard, Herefordshire.
Warmley (Bristol) R.D.C. Erection of 30 dwellings at Cadbury Heath, Bitton and Oldland Common Council Offices, Warmley House.
Whitechurch (Salop) R.D.C. Erection of 40 houses at Smallbrook and 4 flats in Claypit St. Surveyor, F. W. Sanders, Council Offices, 12 St. Mary's St.
York T.C. Erection of 100 houses on Chapel Fields estate. E. Firth, City Architect, 8 St Leonard's Place.

Overseas

India. Mr Nath, managing director of Electrical Machines Corpn. Ltd., Post Box 800, Calcutta 1, is sailing for U.K. on 3 Mar. He wishes to buy machinery for drawing, patenting (heat treated) galvanising high tensile steel wires; rolling mill machinery for rolling ⅜ in. aluminium rod for aluminium bars or ingots; and machinery for making prestressed concrete poles and beams. Letters from interested firms addressed to the ELECTRICAL TIMES will be forwarded to Mr Nath on his arrival.

Bird and Co., Ltd., Chartered Bank Buildings, Netaji Subhas Rd, Calcutta, want to represent U.K. manufacturers of switchgear, hoists and crabs, mining machinery, mechanical handling plant, etc.
Malta. Representation of U.K. suppliers of electrical apparatus, fittings lamps, transformers, motors, etc., sought by Nestor S. Jacons of J. F. Jacons and Sons, Mannarino Rd, B'kara.

Gazette Announcements

COMPANIES ACTS

Electrocult Ltd. Meeting of members will be held on 10 Mar. at 99a Park Lane, London, W.1, at 10 a.m., to receive liquidator's report.

Frigeraids (Grimsby) Ltd. Resolution for voluntary winding-up passed at meeting on 28 Jan. L. G. Jervis, C.A., of 17 Hainton Ave, Grimsby, was appointed liquidator.

Peerless Refrigeration Ltd. First and final dividends of 1s. 6d. in £ payable at 100 Park St, London, W.1, tomorrow Fri. (18 Feb.).

Staveley Electric Supply Co., Ltd. E. R. Birley of 17 Gluman Gate, Chesterfield, has been appointed liquidator in place of James Gadsby, deceased.

M.C.L. Electrical Ltd. Meetings of creditors and contributories will be held at Inveresk Hse, (Room 401), Strand, London, W.C.2, on 21 Feb. at 11.30 a.m. and 12 noon respectively.

Partnership Dissolved

L. Feather and Sons. Partnership between Edward T. Feather and Jack Feather, trading as plumber and electrician at 7 Hilderthorpe Rd, Bridlington, dissolved as from 4 Feb. Debts will be received and paid by the partners.

BANKRUPTCY ACTS

Public Examination

Brighton. Victor G. Palmer, electrical engineer trading at 8 Tudor Close, Hove. Public examination will be at the Court House, Church St, Brighton, on 18 Mar. at 10.30 a.m. First meeting took place on Tues. (15 Feb.).

Release of Trustee

Banbury. Herbert F. Thorrington, electrical contractor of Eydon, Northants. Trustee was W. J. Wallis, Official Receiver, 58-61 York Terr, Regents Park, London, N.W.1.

Intended Dividends

Liverpool. William R. Eagle, electrical contractor trading at 10 Houghton Chambers, 1 Houghton Place, Liverpool. Last day for receiving proofs, 22 Feb. Trustee is E. S. Browne, C.A., 41 North John St, Liverpool 2.

Order on Application for Discharge

Stourbridge. Frederick R. A. Lock and Victor C. Lock, electrical engineers trading at Union St, Stourbridge. Order made on 13 Jan. Separate application of V. C. Lock. Nature of order: discharged subject to consent to judgement for £50 being entered against him by Official Receiver and pay £1. 10s. costs of judgement. (£50 and £1. 10s. costs paid Official Receiver in lieu of entering up judgement.)

MEETINGS TO NOTE

THURSDAY, 17 FEB.

I.E.E. (London Utilisation). "Introduction to Study of Servo-Mechanisms," P. J. Bhatt; "Development of 50 c/s Traction in France," E. J. Davies; "Electricity Applied to Oil Production," G. Gascoigne. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Southern). "Owen Falls Hydro-Electric Scheme," T. A. L. Paton and R. G. T. Lane. Portsmouth College of Technology, 6.30 p.m.

I.E.E. (S. Western sub-centre). "Submerged Telephone Repeaters for Shallow Water," R. J. Halsey and F. C. Wright. Electric Hall, Torquay, 3 p.m.

I.E.E. (Irish). "New Design of Control Installations for Transmission Stations," G. M. Mulhern and D. W. O'Neill. Trinity College, Dublin, 6 p.m.

CHELMSFORD ENGRNG. SOC. "Glass from the Engineers' Viewpoint," P. M. Davidson. Crompton's Social Hall, 7.30 p.m.

A.S.E.E. (Watford). "Electricity in Brewing Industry." Clarendon Hotel, 8 p.m.

A.S.E.E. (Kent). Film Show at Rose and Crown Hotel, Tonbridge, 8 p.m.

S. WALES INST. OF ENGINEERS. "Uskmouth Power Station, especially mechanical plant and equipment." T. H. Wood, Park Place, Cardiff, 6 p.m.

FRIDAY, 18 FEB.

I.E.E. (N. Ireland) Annual dinner-dance at Grand Central Hotel, Belfast, 7.15 p.m.

E.P.E.A. (S. Meter Engrs. Group). "Repair of Electricity Meters," W. Jones and F. A. Miles. Caxton Hall, Westminster, 6.30 p.m.

ELECT. TRADES COMMERCIAL TRAVELLERS' ASSOC. Annual Luncheon at Connaught Rooms, W.C.2, 12.15 p.m.

SATURDAY, 19 FEB.

A.S.E.E. (Oxford). "Fluorescent Lighting Maintenance, Colour Changing and Dimming," H. Hewitt. Y.M.C.A., 10 George St, 6.30 p.m.

MONDAY, 21 FEB.

I.E.E. (London Radio). "Search for and Salvage of Comet Aircraft near Elba," Cdr. C. G. Forsberg and G. G. MacNeill. Savoy Place, W.C.2. 5.30 p.m.

I.E.E. (N.E. Radio and Measurements). "Measurement of Winding Resistance of 132 kV Power Transformer in Service," K. J. R. Wilkinson and J. D. Harmer. King's College, Newcastle, 6.15 p.m.

I.E.E. (N. Midland). Faraday lecture on "Courier to Carrier in Communications," T. B. D. Terroni. Town Hall, Leeds, 7 p.m.

IPSWICH ELECTRICAL ASSOC. Open Forum at Electric Hse, 7.30 p.m.

BIRMINGHAM ELECTRIC CLUB. "Some Thoughts of a Control Gear Maker," A. V. Lawry. Grand Hotel, 5.30 p.m.

N. EAST ELECTRIC CLUB. Ladies' Night.

I.E.E. (Mersey and N. Wales). "Electrification of Manchester-Sheffield-Wath Lines of B.R.," J. A. Broughall and K. J. Cook, Liverpool Royal Instn., Colquitt St, 6.30 p.m.

A.S.E.E. (Bournemouth). Melling Region Lecture: "Relays and Automatic Control in Industry." Dr W. L. Stern, Grand Hotel, 7 p.m.

TUESDAY, 22 FEB.

I.E.E. (E. Midland). "Nuclear Reactors and Power Production," D. R. Poulter. Loughborough College, 6.30 p.m.

I.E.E. (N. Midland Utilisation). Discussion on "Power Factor and Methods of Correction," W. A. Brecknell. Elect. Offices, 1 Whitehall Rd, Leeds, 6.30 p.m.

I.E.E. (N.W. Measurements). "Electrical and Magnetic Measurements in Electrical Engineering Factory," D. Edmundson. Engrs' Club, Albert Sq, Manchester, 6.15 p.m.

I.E.E. (S.E. Scotland). "Electricity in Wool and Textile Industry," A. J. Francis and T. H. Carr. Douglas Hotel, Galashiels, 7.30 p.m.

COVENTRY ELECTRIC CLUB. "Progress in Lamps and Lighting," H. R. Ruff. Elect. Sports and Social Club, Merrick Lodge, St. Nicholas St.

MIN. OF WORKS LECTURE (Bolton). "Powered Hand Tools," A. F. Coare. Tech. College, 7.15 p.m.

WEDNESDAY, 23 FEB.

I.E.E. (London Supply). "High-Voltage Transmission Developments in Sweden," A. Rusck. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Southern) Sir Christopher Hinton's Clayton Lecture on "Nuclear Reactors in Power Production," read by Dr J. Kay. R.A.E. Tech. College, Farnborough, 7.30 p.m.

BRITISH INSTN. OF RADIO ENGRS. (S. Wales). "Training of Radio Engineers," H. W. French. Glamorgan Tech. College, Treforest, 6.30 p.m.

BRITISH INSTN. OF RADIO ENGRS. (London). "Versatile Electronic Engine Indicator," R. K. Vinycomb. School of Hygiene, Keppel St, W.C.1, 6.30 p.m.

THURSDAY, 24 FEB.

I.E.E. Annual dinner at Grosvenor Hse, Park Lane, W.1, 7 p.m.

I.E.E. (N. Midland). "Technical Arrangements for Sound and TV Broadcasts of Coronation," W. S. Proctor, M. J. L. Pulling and F. Williams. Elect. Offices, Ferensway, Hull, 7.15 p.m.

I.E.S. (Glasgow). Annual dance.

INST. OF FUEL (Scottish). "Some Aspects of Problem of Air-Heating," J. F. S. Kistruck. North British Hotel, Edinburgh, 7 p.m.

INSTN. OF ENGRNG. INSPECTION (N. Western). "Quality Control," E. Summerscales. Engrs. Club, Albert Sq, Manchester, 7.30 p.m.

NOTTS ELECTRICAL CLUB. "Playing with Electricity," T. E. Hartley. Reform Club, Victoria St, 7 p.m.

MIN. OF WORKS LECTURE (S. Shields). "Advantages of Thermal Insulation of Building Structures," J. S. Alton. Marine and Tech. College, 7 p.m.

E.P.E.A. (Midlands). "Electrical Power from Nuclear Reactors and Its Use in Their Operation." F. M. Greenlees, Imperial Hotel, Birmingham, 7 p.m.

FRIDAY, 25 FEB.

I.E.E. (Southern). "Demonstrations of Principles of Modulation and of Behaviour of Circuit Noises," J. W. R. Griffiths. S. Dorset Tech. College, Weymouth, 6.30 p.m.

I.E.E. (S. Midland). "Exam Regulations of Institution," N. C. Stamford. College of Technology, Broad St, Birmingham, 5.30 p.m.

I.E.S. (Bath and Bristol) and E.A.W. Brains Trust at Royal Hotel, Bristol, 6.15 p.m.

I.E.S. (Birmingham). Annual meeting. "Terms and Techniques for Satisfactory Lighting," J. G. Holmes. Regent Hse, St. Phillip's Place, Colmore Row, 6 p.m.

IPSWICH ELECTRICAL ASSOC. Ladies' Night at Red Lion Hotel, Colchester.

A.S.E.E. Ladies' Night—dinner, dance and cabaret—at Trocadero Restaurant, London, W.1.

S. WALES INST. OF ENGINEERS. "Energy Resources of Canada." David Cass-Beggs, Park Place, Cardiff, 6 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

C. M. Hartshorne and Co., Ltd. 778 Newhey Rd, Outlane, Huddersfield. Traders in electrical and mechanical machinery, etc. Nom. cap.: £500. Dirs.: Mrs C. M. Hartshorne and Miss J. C. Hartshorne.

Farnell Instruments Ltd., manufacturers of and dealers in electronic appliances, etc. Nom. cap.: £1,000. Dirs.: A. Woffenden, 3 Primley Gdns, Moortown, Leeds, A. C. Farnell, 12 Heaton Park Rd, Bradford 9, and J. D. Ramshall.

Metersprays Ltd. Manufacturers of and dealers in valves and valve components, engineers, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Edna M. Brown, 9 Harcourt Hse, Cavendish Sq, W.1, and Sheila M. Payne, 38 Westbrook Hse, Victoria Park Sq, E.2.

Martin Electric (London) Ltd. 39 Windus Rd, N.16. Manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Nom. cap.: £1,000. Dirs.: H. Daum and M. Elliott.

Neon Trading Ltd. Manufacturers of and dealers in neon lighting apparatus, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: J. A. South, 72 Malvern Drive, Ilford, Essex, and S. J. Cocksworth, 21 Ely Place, E.C.1.

J. R. Every and Son Ltd. 142 Maybury Rd, Woking, Surrey. Electrical engineers and contractors, etc. Nom. cap.: £100. Dirs.: J. R. Every, Mrs E. M. Every and P. I. Roach.

J. D. Electronics (Birmingham) Ltd. 173/4 High St, Deritend, Birmingham. Nom. cap.: £100. Dirs.: J. J. Dorey, C. A. Taylor, F. C. Skelding, A. J. Greenwood and A. Black.

Jackson and Padgett Ltd. Kingsway Chambers, 4 New Walk, Leicester. Manufacturers of and dealers in refrigerators, etc. Nom. cap.: £20,000. Permt. gov. dir. and ch.: M. I. Jackson.

Andover Sewing Machines Ltd. Wickham Hse, St Thomas St, Winchester, Hants. Manufacturers of and dealers in domestic, household and general electrical and other equipment, including sewing, washing and cleaning machines, etc. Nom. cap.: £10,000. Dirs.: V. G. Loyd, A. A. Woor, N. B. Nutt and R. C. Cartwright, addresses not stated. Subs.: C. Polaine, 27 Southsea Av, Leigh-on-Sea, Essex, and J. Langdon, 48 Wheatland Hse, Dog Kennel Hill, East Dulwich S.E.

Defesco Sound Equipment Ltd. Moorings, Middle St, Nazeing, Essex. Nom. cap.: £100. Dirs.: A. W. Arnold and Amy E. Arnold.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

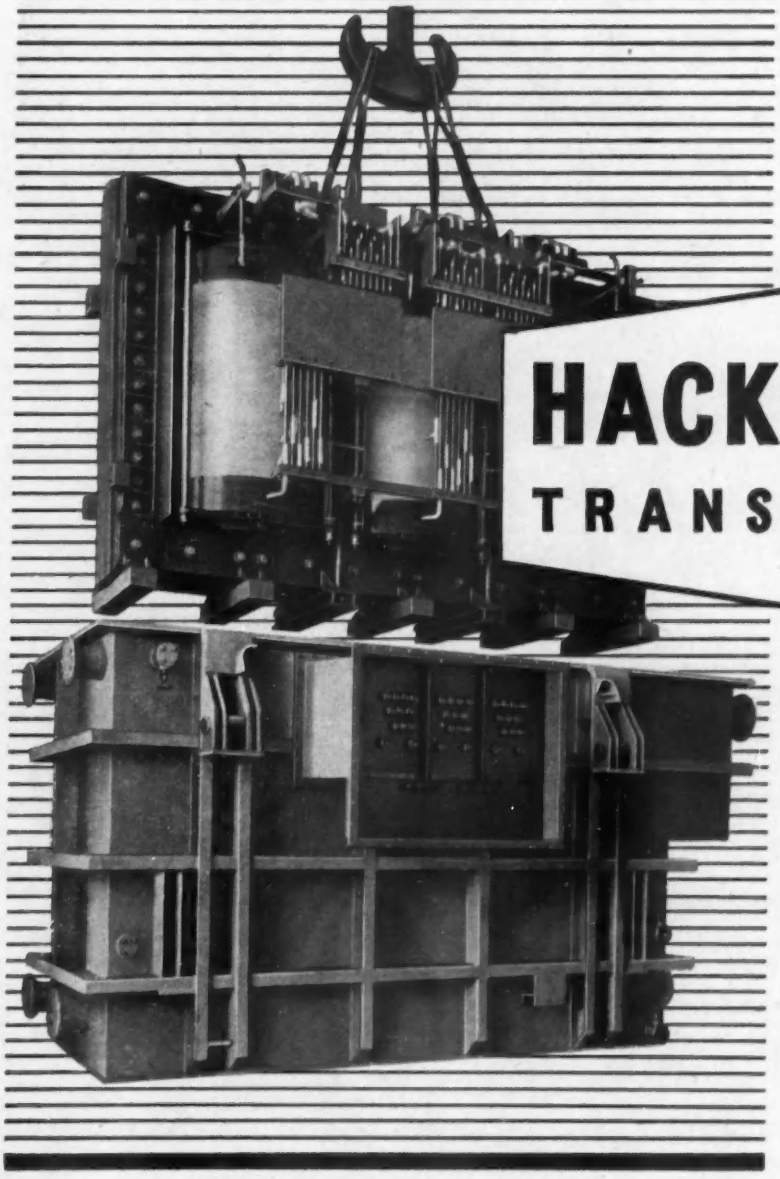
Mekelond. 736,396. Class 11. Lighting installations. Mekelek Eng. Ltd., 17 Western Rd, Mitcham, Surrey.

Nashton. 736,463. Class 9. Thermostats, automatic temperature regulators etc. 736,465. Class 14. Control clocks and electrically driven clock mechanisms. Nash and Thompson Ltd., Oakcroft Rd, Tolworth, Surrey.

Nikad. 732,697. Class 9. Sound amplifiers, battery chargers, etc. Nikad Supplies, 13 Church Rd, Edgbaston, Birmingham 15.

Payu. B730,726. Class 11. Electric lamps, etc. Howards (Newcastle) Ltd., 14/22 Pitt St, Newcastle-upon-Tyne 4.

Rowlway. 735,156. Class 9. Sound recording and reproducing apparatus, etc. Sedlescombe Eng. Co., Ltd., The Street, Sedlescombe near Battle, Sussex.



HACKBRIDGE
TRANSFORMERS

Typical 45 MVA Hackbridge transformer 66/33 kV. type ON/OFB, for British Railways.

✻ *There are 20 million kVA of Hackbridge Transformers in World-wide service*

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone : Walton-on-Thames 760 (8 lines) *Telegrams : "Electric, Walton-on-Thames"*

WESTON panel instruments

Both round and rectangular models of moving iron, moving coil, A.C. rectifier and H.F. thermocouple types are offered. In the range of rectangular instruments, which have been introduced to give the advantage of long, easily-read scales and to harmonize with rectangular panels, certain models are available with illuminated dials. Full particulars of types and ranges available are to be found in leaflets List Nos. W.1 and W.2, copies of which are available on request.

Rectangular panel instruments are available with scale lengths of 2·5″, 3·2″, and 4·2″. These offer the advantage of an increase in scale length of approximately 50% over their equivalent round models, for which they can be used as direct replacements using the same panel fixing holes.

Round models are housed in cases of 2″, 2½″ and 3½″ diameter and have scale lengths of 1·7″, 2·1″ and 2·8″ respectively.

Larger instruments, both round and rectangular and for switchboard or panel mounting, are also available. These have scale lengths of 6″ and 6½″ respectively.

SANGAMO WESTON LIMITED

Enfield, Middlesex · Tel: ENField 3434 (6 lines) & 1242 (6 lines) Grams: Sanwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151
Branches: London, CHAncery 4971 · Glasgow, Central 6208 · Manchester, Central 7904 · Newcastle-on-Tyne, Newcastle 26867
Leeds, Leeds 30867 · Liverpool, Central 0230 · Wolverhampton, Wolverhampton 21912 · Nottingham, Nottingham 42403
Bristol, Bristol 21701 · Southampton, Soton 23328 · Brighton, Brighton 28497

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

BOROUGH OF CHELTENHAM

TRUNK ROAD LIGHTING:
LONDON-FISHGUARD TRUNK ROAD (A.40)

TENDERS are invited for the supply and erection of a Group "A" Sodium discharge lighting installation as follows:

Bill No. 1: For the supply of only 70 No. 140 W complete cut-off lanterns and lighting equipment.

Bill No. 2: For the supply and erection of 69 No. Concrete columns together with fitting and wiring of tenderers own lighting equipment.

Bill No. 3: As Bill No. 2 but for fitting and wiring of lighting equipment offered by another firm.

Specification and Bills of Quantities can be obtained from the undersigned on payment of a deposit of Three Guineas, which will be refunded on receipt of a bona fide tender, not subsequently withdrawn, and the return of all documents.

Drawings and Conditions of Contract can be inspected at this office during the usual working hours.

Tenders, together with fully-priced Bills of Quantities are to be submitted, in the envelope provided, to the Town Clerk, P.O. Box 12, Municipal Offices, Cheltenham, not later than first post, Monday, 14 Mar., 1955.

The Council reserves the right to treat each Bill of Quantities as a separate tender, and does not bind itself to accept the lowest or any tender.

G. GOULD MARSLAND,
M.B.E., B.SC., M.I.C.E.,
Borough Engineer.

P.O. Box 12,
Municipal Offices,
Cheltenham. (P 805)

CITY OF BELFAST
Electricity Department

PARALLEL SLIDE VALVE; BOMB CALORIMETER, ETC.

TENDERS are invited for the supply and delivery of:

(*a*) 14 in. bore parallel slide valve for steam plant (specification No. W.69).

(*b*) Bomb calorimeter and accessories (specification No. W.70).

Forms of Tender and specifications may be obtained at the Electricity Department, East Bridge St, Belfast.

Each Tender, in sealed envelope marked "Tender for . . ., Electricity Committee," and endorsed with the name and address of the tenderer, must reach the undersigned not later than 4 p.m. on Friday, 11 Mar., 1955.

An official receipt must be obtained for each Tender delivered by hand. Tenders sent by post should be registered.

The lowest or any Tender will not necessarily be accepted.

JOHN DUNLOP,
Town Clerk.

City Hall, Belfast,
P.O. Box 234.
14 Feb., 1955. (P 804)

COUNTY BOROUGH OF GREAT YARMOUTH

ANNUAL CONTRACTS

THE Council invite tenders for the supply of Electric Cables for a period of one year from 1 Apr., 1955.

Specifications, Forms of Tender and Conditions of Contract may be obtained from the Borough Engineer, Town Hall, Great Yarmouth. Tenders on the forms supplied in a plain sealed envelope endorsed "Tender for Electric Cables" must reach me not later than Wednesday, 2 Mar., 1955.

No guarantee is given that the lowest or any tender will be accepted.

FARRA CONWAY,
Town Clerk.

Town Hall,
Great Yarmouth.
8 Feb., 1955. (P 790)

BOROUGH OF WIDNES

TENDER FOR MATERIALS

THE Corporation invite Tenders for the supply of the undermentioned material required in the Highways Department during the twelve months ending 31 Mar., 1956:

Electrical Equipment

Form of Tender and Specification may be obtained from James Holt, Esq, A.M.I.C.E., M.I.MUN.E., Borough Engineer and Surveyor, Town Hall, Widnes.

Tenders in plain sealed envelopes endorsed "Tender for Electrical Equipment," to be forwarded to reach the undersigned not later than the first post on 1 Mar., 1955.

The Council do not bind themselves to accept the lowest or any tender.

FRANK HOWARTH,
Town Clerk.

Town Hall,
Widnes.
Feb., 1955. (P 771)

THE HYDRO-ELECTRIC COMMISSION
Tasmania

TENDERS FOR ELECTRICALLY DRIVEN PUMPING PLANT

TENDERS will be received by the Secretary, The Hydro-Electric Commission, Elizabeth St, Hobart, Tasmania, Australia, until noon on Thursday, 31 Mar., 1955, for the design, supply and delivery of Electrically Driven Pumping Plant to consist of a number of pumps to be operated in sequence to give a variable output up to a total of 100 cu secs against a static head of 150 ft.

Specification C.E. 489 and drawing are available on application to the Agent General for Tasmania, 457 Strand, Charing Cross, London, W.C.2.

W. R. SPINNER,
Secretary.
(P 794)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

MUNICIPALITY OF GEORGE TOWN, PENANG
Federation of Malaya

SENIOR POWER STATION ENGINEER

THE MUNICIPAL COUNCIL invites applications for a vacancy in the permanent establishment of the Electricity Supply Department. The duties of the post include organisation and supervision of mechanical maintenance work on Boilers, Turbines and usual auxiliary plant but not responsibility for electrical maintenance or taking charge of shifts.

Candidates should be experienced in the operation of modern steam turbine and boiler plant (either in a power station or on board ship) with steam conditions of 400 p.s.i./8800° F or higher, and should preferably be between the ages of 25 and 45.

Appointment in the first instance will be for a term of three years in the salary scale of (*a*) $510-30-750/780-30-1,020 per month or (*b*) $528-36-852/912-36-1,200 per month according to qualifications. ($1=2s. 4d.) In addition allowances payable at present rates raise the annual emoluments on the minimum and maximum points of the above scales to the following:

		min.	*max.*
For a bachelor	Scale (*a*)	£1,197	£1,862
For a bachelor	Scale (*b*)	£1,218	£2,100
For a married man	Scale (*a*)	£1,407	£2,247
For a married man	Scale (*b*)	£1,440	£2,499
For a married man with children	Scale (*a*)	£1,498	£2,471
For a married man with children	Scale (*b*)	£1,531	£2,730

Free passages to Penang for the successful candidate, his wife and children under the age of twelve years will be provided and upon completion of the first tour of service (3-4 years) free homeward passages will similarly be provided.

The Municipal Council at present operates a scheme of medical benefits for officers and their families which includes treatment at modern and well-equipped Government Hospitals.

Housing accommodation (including heavy furniture) will be provided at a nominal rental (at present not more than $35 per month).

The successful candidate will be required to contribute to a Provident Fund 10% of his basic salary and expatriation allowance during the first five years' service and thereafter 15%. The Council donates an equal amount. An officer who has completed five years' service with the Council is entitled upon resignation from the service to be paid the sum of the Council's donations and his own contributions together with accrued interest on both sides.

The Council's leave regulations provide for fourteen days' local leave each year plus generous home leave upon completion of each tour of service. The normal length of tour varies from two years to a maximum of four years depending on the age and length of service of the officer.

Applications in Duplicate, giving full particulars of education, technical training, qualifications, practical and executive experience together with copies of three recent testimonials (also in duplicate) should be sent to Messrs Allen and Williams (Agents to the Municipal Council), 1 Victoria St, London, S.W.1, before 10 Mar., 1955.

(P 701)

SOUTHERN ELECTRICITY BOARD

SENIOR ASSISTANT
(PUNCHED CARD INSTALLATION)

SUB-AREA Accountant's Department, No. 2 (Newbury) Sub-Area. Salary N.J.C. Grade 5 (£720/£795 per annum). N.J.C. Conditions of Service.

The successful candidate will be required to assume responsibility for the operation of a Powers-Samas Installation and for the control and training of operators. A sound knowledge of accounting procedures relating to Wages, Stores and Costing by Punched Card methods is essential.

The successful candidate will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, and returned to him in envelopes suitably endorsed, not later than 4 Mar., 1955. (P 812)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY
A.E.R.E., Harwell, Berks

requires a SENIOR EXPERIMENTAL OFFICER or EXPERIMENTAL OFFICER to take charge of the running, maintenance and improvement of a high voltage ion accelerator used for nuclear physics research. He will be responsible for the design of electrical and vacuum apparatus required for work on the measurement of nuclear constants and to co-operate with a team of scientists engaged in such measurements. The work will offer a good opportunity to learn the basic facts about Atomic Energy. Applicants should be at least 26 years of age and possess minimum qualifications of Higher School Certificate in Physics or equivalent qualification in Electrical Engineering. Experience of metal vacuum systems and/or high voltage equipment is desirable. Some experience of light electrical engineering design and electronic circuitry would be an advantage. A good practical man with some of the engineer's outlook is required. The successful candidate will be appointed either as a Senior Experimental Officer (£1,090/£1,285 per annum) or Experimental Officer (£775/£945 per annum), according to age, experience and qualifications, and will be required to join the Authority's contributory superannuation scheme. Houses on a rental basis will be available in a reasonable period of time for married officers who live outside the radius of the Establishment's transport facilities. Applications should be sent to Establishments Officer, United Kingdom Atomic Energy Authority, A.E.R.E. Harwell, Didcot, Berks, quoting 2/103/233. (P 799)

BRITISH ELECTRICITY AUTHORITY
South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments.

DIVISIONAL HEADQUARTERS

(1) Vacancy No. 17/55. 3RD ASSISTANT ENGINEER, Construction Section—Transmission Department.

Salary: AX/DX4—£750/£950 per annum.

Applicants should have had experience in the supervision of H.V. Substations and overhead line construction work. Knowledge of 132 kV equipment advantageous. Qualification H.N.C. (Electrical) or equivalent.

(2) Vacancy No. 18/55. 3RD ASSISTANT ENGINEER (MECHANICAL) Generation (Construction) Department.

Salary: AX/DX4—£750/£950 per annum.

Qualification—H.N.C. or equivalent.

Experience of Power Station construction desirable. Ability to make investigations and prepare schemes and specifications for new projects.

CARMARTHEN BAY POWER STATION

(3) Vacancy No. 21/55. STATION SHIFT CONTROL ENGINEER.

Salary: K.10—£790 x £20—£850.

H.N.C. and experience in power station control room desirable.

Closing date 4 Mar., 1955.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff. (P 828)

LONDON ELECTRICITY BOARD
ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position in South Western District, based at Battersea, London, S.W.11.

Applicants should have had a good general education and technical education up to Ordinary National Certificate standard. They should have had considerable experience in transformer chamber layouts, mains records and system diagrams. Knowledge of building construction would be an advantage.

The post is graded under Schedule D of the National Joint Board agreement as Grade 6—£535. 10s./£661. 10s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46/7 New Broad St, London, E.C.2, to be returned completed by 28 Feb., 1955. Please enclose addressed envelope and quote ref.: V/1909/T on envelope and all correspondence. (P 768)

BRITISH ELECTRICITY AUTHORITY
Yorkshire Division

APPLICATIONS are invited for the following appointments:

DEPUTY STATION SUPERINTENDENT, ROTHERHAM POWER STATION

Salary £1,110/£1,200 per annum, Class H, Grade 3, N.J.B. Agreement.

Applicants should preferably possess corporate membership of the Institution of Mechanical or Electrical Engineers and have had experience in the operation and maintenance of modern power station plant.

THIRD ASSISTANT ENGINEER (MECHANICAL) GENERATION CONSTRUCTION DEPARTMENT, ROTHERHAM

Commencing salary will be within Grade 4 of Schedule C of the N.J.B. Agreement, i.e. £750/£875 per annum according to qualifications and experience, rising ultimately to a maximum of £975 per annum.

Applicants should possess the Higher National Certificate or equivalent qualifications and have had works and drawing office experience. The successful candidate will be required to carry out duties in connection with the preparation of specifications and the installation of mechanical equipment for power stations.

Application Forms obtainable from Divisional Secretary (Establishments), British Electricity Hse, St. Mary's Rd, Leeds, 7, to be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
(P 808)

AIR MINISTRY

require MECHANICAL and ELECTRICAL ENGINEERS in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation Stations. Appointments in two grades (*a*) Main Grade, salary scale £1,118 to £1,463. (*b*) Assistant Grade £729 to £1,118. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Candidates should be age 25 or over. Appointments temporary and non-pensionable but with long-term possibilities. Special allowance up to £1,500 a year according to location payable in addition to salary during overseas service. Candidates must be natural born British subjects of natural born British parents. Minimum qualifications and experience for both grades of posts: (i) (*a*) University degree or equivalent diploma in electrical and/or mechanical engineering and at least a two-year apprenticeship or (*b*) Graduate or Corporate Membership of the Institutions of Mechanical or Electrical Engineers with appreciable electrical engineering experience and at least three-year apprenticeship and (ii) employment in responsible position for minimum of three years with well-established engineering concern providing wide experience in electrical and mechanical engineering practice.

Application forms quoting ref. D.530/54-A from M.L.N.S., Technical and Scientific Register (K), Almack Hse, 26 King St, London, S.W.1. (P 501)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

A GENERAL ASSISTANT ENGINEER is required in the System Development Section of the Divisional Technical Department. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 6, of the Agreement, commencing in range £600/£725, and ultimately rising to £785 per annum.

A recognised academic and practical training in electrical engineering is essential, and experience in the electrical supply industry or with a switchgear manufacturer will be considered an advantage. Applicants should have an aptitude for power system calculations, and for the investigation of general power system problems such as cable and switchgear ratings.

Apply, quoting Vacancy No. 888MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 3 Mar., 1955. (P 802)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments which are superannuable and subject to medical examination:

1. DISTRICT ENGINEER in the Liverpool Central District. Salary £1,195/£1,300 per annum (N.J.B. H/2). Applicants should preferably be chartered Electrical Engineers and have had sound experience in the construction, maintenance and operation of large transmission and distribution networks for all voltages up to and including 33 kV.

Special application forms obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3. Closing date: 28 Feb., 1955.

2. COMMERCIAL ASSISTANT in the Aberystwyth district of the Board's No. 4 Sub-Area based on Barmouth. Salary £595/£640 per annum (N.J.B. C/8). Applicants should have had an engineering training, experience in dealing with installation work, consumers' supply enquiries and general commercial duties. Ability to speak Welsh advantageous.
3. COMMERCIAL ASSISTANT in the Board's No. 4 Sub-Area based on Oswestry. Salary £555/£600 per annum (N.J.B. E/11). Applicants should have had an engineering training, experience in dealing with installation work, consumers' supply enquiries and general commercial duties.

Applicants for posts 2 and 3 should preferably have the technical qualifications to enable them to become Chartered Electrical Engineers.

Application forms for posts 2 and 3 obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, Near Wrexham. Closing date: 28 Feb., 1955. (P 774)

BRITISH ELECTRICITY AUTHORITY
South Western Division

TECHNICAL DEPARTMENT VACANCIES

GENERAL ASSISTANT ENGINEER, Plymouth Region, N.J.B. Class AX/CX Grade 6, £600 x £25—£725/£765.

JUNIOR ASSISTANT ENGINEER, Bristol Region, N.J.B. Class AX/CX, Grade 7, £475 x £15—£550/£590.

Superannuation.

Applicants should possess qualifications leading to A.M.I.E.E., and have served with one of the leading electrical manufacturers. They should have an interest in protective gear design and switchgear testing.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 28 Feb., 1955. (P 783)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD
Lanarkshire Sub-Area

APPOINTMENT OF GENERAL ASSISTANT ENGINEER (SUB-AREA OPERATION AND MAINTENANCE DEPARTMENT)

APPLICATIONS are invited for the above appointment. Candidates for this appointment should have had a sound engineering training followed by some experience on the Distribution side of the Electricity Supply Industry.

The Salary and Conditions of Service for the appointment will be in accordance with the National Joint Board's Agreement, Schedule A, the present Classification and Grading is K.13. Salary £675/£720 per annum, which will be subject to the statutory deductions including superannuation. The successful candidate will require to reside within a reasonable distance of the Sub-Area Offices at Hamilton.

Application forms, which may be obtained from the undersigned, should be returned to this office within 14 days of the date of this advertisement.

DUGALD SMITH,
Manager.
137 Almada St,
Hamilton. (P 795)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

APPLICATIONS are invited for the following positions in the Generation Construction Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointments, salaries within Schedule D of the Agreement:

(*a*) SENIOR DRAUGHTSMAN (Mechanical), Grade 4, £750/£850 per annum (Vacancy No. 879MD).

(*b*) SENIOR DRAUGHTSMAN (Mechanical), Grade 5, £640/£740 per annum (Vacancy No. 880MD).

(*c*) ENGINEERING DRAUGHTSMAN (Electrical), Grade 6, £510/£630 per annum (Vacancy No. 883MD).

Applicants for (*a*) and (*b*) should have experience in the layout and design of power station mechanical plant, including boilers, turbo-alternators and ancillary equipment; high and low pressure steam and feed pipework; condensing plant and feed heating systems. For (*c*) experience is required in the layout of electrical equipment for power stations, including lighting installations and auxiliary power systems. Appropriate technical qualifications will be an advantage.

Apply, quoting the vacancy number, on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 5 Mar., 1955. (P 803)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

North Staffordshire Sub-Area

SENIOR ASSISTANT ENGINEER (OPERATION)
SUB-AREA HEADQUARTERS

Applicants should have had wide experience in the operation and maintenance of H.V. transmission and distribution networks. Duties will be those normally associated with the post, including fault location, supervision of Distribution System Control, and the maintenance of remote control equipment. Technical qualifications desirable. Salary £1,195/£1,300 per annum (N.J.B. Grade K.4). Apply, in writing, within 14 days stating age, experience, present salary and position to Mr H. A. P. Caddell, Sub-Area Manager, Midlands Electricity Board, 31 Kingsway, Stoke-on-Trent.

Worcester and District Sub-Area

DISTRICT ENGINEER (BANBURY DISTRICT)

The successful candidate will be responsible to the District Manager for all Engineering matters and should have had extensive experience in the Planning, Construction, Operation and Maintenance of H.V. and L.V. systems. Technical qualifications desirable. Salary £840/£900 per annum (N.J.B. Grade D.3).

ENGINEERING DRAUGHTSMAN
(KIDDERMINSTER DISTRICT)

Applicants should be conversant with, and proficient in, the preparation of engineering drawings, maps and plans in connection with mains distribution system. Experience in the Electricity Supply Industry will be an advantage. Salary £510/£630 per annum (N.J.B. Schedule D, Grade 6).

Apply, in writing, within 14 days stating age, experience, present salary and position to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS,
Secretary.
(P 806)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

SHIFT CHARGE ENGINEER is required at Stoke Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade E7, commencing at £715 per annum.

A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear are required. Appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 887MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 5 Mar., 1955. (P 801)

ATHENS PIRAEUS ELECTRICITY COMPANY LTD.
Athens, Greece

THE Athens Piraeus Electricity Company, which is under British management, has a vacancy in Athens for a really first-class young BRITISH ELECTRICAL ENGINEER (in his twenties) with sound theoretical and practical knowledge of steam power engineering. Applicants should be fully qualified, preferably with a good honours degree. They must be of the type who can command the respect and friendship of able and experienced Greek engineers working for the company, as well as of the British staff. A substantial salary can be paid to the right man. Reply to the Secretary of the company's London agents, Whitehall Securities Corporation Ltd., 47 Parliament St, London, S.W.1. (P 733)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside & N. Wales Division

VACANCY No. E.81/55/T. STATION SHIFT CONTROL ENGINEER, Barrow Generating Station. Salary £555 x £15—£600 (D.10).

Vacancy No. E.81/56/T. SHIFT CHARGE ENGINEER, Lister Drive Generating Station, Liverpool. Salary £755 x £15—£800 (F.7).

Apply to Divisional Secretary, British Electricity House, 825 Wilmslow Rd, Manchester 20, before 26 Feb. Quote Vacancy No. (P 785)

THE SOUTH WEST SCOTLAND ELECTRICITY BOARD
Glasgow Sub-Area

APPLICATIONS are invited for the following appointment. The salary and conditions of employment will be in accordance with the Agreement of the National Joint Board.

THIRD ASSISTANT ENGINEER
(CONSTRUCTION)

Candidates should have had a sound engineering training and wide experience in cable laying, at voltages up to and including 33 kV, in a densely loaded industrial and residential area and be capable of taking charge of cable laying operations throughout the Sub-Area. Corporate Membership of the Institution of Electrical Engineers or the possession of the Higher National Certificate or an equivalent qualification would be an advantage.

Salary Scale: £790/£850 per annum, Class K, Grade 10.

The successful applicant will require to reside within reasonable distance of Sub-Area Headquarters.

Applications should be made on form to be obtained from the undersigned and should be completed and returned not later than Monday, 14 Mar., 1955.

Any applicant who has submitted an application for another post in the Sub-Area in the past six months need only request that his previous application should be considered for the above post.

A. KELSO,
Manager.
75 Waterloo St, Glasgow C.2. (P 830)

IMPERIAL CHEMICAL INDUSTRIES LIMITED
Wilton Works

INSTRUMENTATION DRAUGHTSMEN

IMPERIAL Chemical Industries Ltd., Wilton Works, near Redcar, Yorkshire, is interested in training MECHANICAL and ELECTRICAL DRAUGHTSMEN for instrumentation work and will be pleased to receive applications. Applicants should possess the appropriate certificate and should have not less than two years' drawing office experience. Experience on instrumentation work is not essential. Full salary rates will be paid during the training period.

Good working conditions including Pension Scheme, Recreation Club, etc. 5-day/39 hours week.

Write for application form to the Staff Officer, Imperial Chemical Industries Ltd., Wilton Works, Middlesbrough, Yorkshire, quoting advertisement ref. ICI/X/214/b. (P 767)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY
A.E.R.E., Harwell, Berks

requires a SENIOR ASSISTANT (SCIENTIFIC) to assist and be responsible to the Officer in charge of the running, maintenance and improvement of a high voltage ion accelerator used for nuclear physics research. The work will involve co-operation with a team of scientists engaged in the measurements of nuclear constants. Applicants should have minimum qualifications of School Certificate including Physics or Mathematics, or Ordinary National Certificate in Physics or Electrical Engineering, or equivalent qualifications. Experience in light electrical engineering and in the maintenance of small electrical machines is desirable. The successful candidate will be appointed within the scale £585/£800 per annum, and will be required to join the Authority's contributory superannuation scheme. Houses on a rental basis will be available in a reasonable period of time for married officers who live outside the radius of the Establishment's transport facilities. Applications should be sent to Establishments Officer, United Kingdom Atomic Energy Authority, A.E.R.E. Harwell, Didcot, Berks, quoting 2/103/234. (P 800)

SOUTH EASTERN ELECTRICITY BOARD

2ND ASSISTANT DISTRICT ENGINEER
Lewes District

SALARY £675/£720 per annum under N.J.B. Class D, Grade 7. Superannuable. Applicants should have suitable technical qualifications and have had training and experience in the planning, construction, operation and maintenance of underground and overhead distribution systems up to 33 kV. Experience of DC/AC changeover an advantage.

Applications, naming 2 referees, to G. R. Lincoln, A.I.E.E., District Manager, SEEBoard, 80/81 High St, Lewes, Sussex, by 2 Mar., 1955.

JOINTER (EXTRA HIGH TENSION)
Worthing District

Wages 4s. 1d. per hr for 44-hr 5-day week under N.J.I.C. Agreement.

Applications, naming 2 referees, to M. J. Mortimer, M.I.E.E., District Manager, SEEBoard, 56 Chapel Rd, Worthing, by 2 Mar., 1955.

A. L. BURNELL,
Secretary.
(P 798)

BRITISH ELECTRICITY AUTHORITY
South Eastern Division

CROYDON "B" POWER STATION

ASSISTANT ENGINEER (Operation and Efficiency). Class J, Grade 8, £840/£900 per annum plus London Allowance. Applicants, who should possess a Higher National Certificate, must have had experience in the operation of modern Power Station plant, plant testing and investigation and be familiar with the use of testing equipment. Applications giving details of education, present position, experience, etc., should be received by the Station Superintendent, Croydon "B" Power Station, Beddington Farm Rd, Croydon, by 26 Feb.

Divisional Headquarters Staff
(BASED AT CROYDON "B" POWER STATION)

GENERAL ASSISTANT ENGINEER (Divisional Assistant Chemist). Class AX/DX, Grade 6, £600/£725/£785 per annum plus London Allowance. Applicants should possess H.N.C. (Chemistry) or equivalent qualification and knowledge of Power Station Chemistry would be an advantage.

JUNIOR ENGINEER (CHEMIST). Class AX/DX Grade 7, £475/£550/£610 per annum plus London Allowance. Applicants should possess O.N.C. (Chemistry) or equivalent qualification and possess a sound knowledge of elementary Chemistry.

Applications for both these positions, giving details of education, present position, experience, etc., should be sent to the Establishments Officer, British Electricity Authority, Lower Ham Rd, Kingston-on-Thames, by 26 Feb. (P 807)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

YORKSHIRE ELECTRICITY BOARD

No. 7 (Grimsby) Sub-Area

Grimsby District

THIRD ASSISTANT DISTRICT ENGINEER

APPLICANTS should be preferably Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications, and should have experience in the design, construction, operation and maintenance of H.V. and L.V. Overhead and Underground Distribution Systems, Substation plant and ancillary equipment.

Salary—N.J.B. Class F, Grade 9, £675/£15/£720 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 3 Mar., 1955.

No. 6 (Hull) Sub-Area

GENERAL ASSISTANT ENGINEER (METERS, TESTING AND PROTECTION)

Applicants must hold the Higher National Certificate in Electrical Engineering or possess equivalent qualifications and should have a sound practical knowledge of Meter and Instrument Technology. Some experience in the commissioning and maintenance of Protection Gear equipment will be an advantage.

Salary—N.J.B. Class K, Grade 13, £675/£15/£720 per annum.

Bridlington District

ENGINEERING DRAUGHTSMAN (DRIFFIELD)

Candidates should be neat and accurate Draughtsmen with experience in the preparation of electrical diagrams, and detail working drawings for Overhead Line Equipment and Substation layouts. The successful applicant will be required to reside in Driffield.

Salary—N.J.B. Schedule D, Grade 6, £510/£70/£630 per annum.

Hull, Bridlington and Goole Districts

JUNIOR ENGINEERS

Applicants should hold the Higher National Certificate in Electrical Engineering or equivalent qualifications, and have had training in the construction, operation and maintenance of H.V. and L.V. overhead and underground Distribution Systems.

The successful candidates will be required to reside in the district to which they are appointed, and may be required to carry out standby duty.

Hull District

Salary—N.J.B. Class J, Grade 17, £475/£15/£520 per annum.

Bridlington District (Driffield)

Salary—N.J.B. Class D, Grade 12, £475/£15/£520 per annum.

Goole District

Salary—N.J.B. Class E, Grade 13, £475/£15/£520 per annum.

Applications, stating the post applied for, and giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston-upon-Hull, not later than 3 Mar., 1955.

No. 3 (Sheffield) Sub-Area

ENGINEERING DRAUGHTSMAN

Applicants should be first-class Draughtsmen, preferably with experience on mains recording with a Public Utility Authority; capable of compiling accurate and permanent records from particulars obtained on site, and carrying out survey work for the revision of ordnance maps and plans.

Salary—N.J.B. Schedule D, Grade 6, £510/£20/£630 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 3 Mar., 1955.

No. 7 (Grimsby) Sub-Area

THIRD ASSISTANT ENGINEER (OPERATION AND MAINTENANCE)

Candidates should be fully experienced in the operation and maintenance of H.V. and L.V. overhead and underground transmission and distribution systems, substation plant and ancillary equipment. They should be suitably qualified and hold at

continued in next column

continued from previous column

least the Higher National Certificate in Electrical Engineering.

Salary—N.J.B. Class H, Grade 10, £715/£15/£760 per annum.

Grimsby District

DEMONSTRATOR

Applicants must have had a two years' full-time course in domestic subjects at a recognised Training College and possession of the E.A.W. Certificate will be an advantage.

Salary—N.J.C. Grade 1, £425/£20/£525 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 3 Mar., 1955. (P 811)

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF THIRD ASSISTANT ENGINEER, TECHNICAL AND RESEARCH SECTION, CHIEF ENGINEER'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER

DUTIES will include a study of the problems arising on a large distribution system. A wide experience of distribution methods is desirable, together with a good knowledge of protective gear. Ability to prepare concise reports will be an advantage.

Technical qualifications should be up to H.N.C. standard in Electrical Engineering.

Salary scale: £750/£975 per annum. Class AX/EX, Grade 4. N.J.B. Conditions.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester, 8, by 26 Feb., 1955.

APPOINTMENT OF GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, SOUTH-WEST DISTRICT, ALTRINGHAM

Applicants should have had experience in the control and supervision of industrial and domestic contract wiring, including preparation of estimates and specifications, together with the delivery, connection, repair and maintenance of appliances in workshops and on consumers' premises.

Salary scale: £555 x £15—£600 per annum. Grade E.11. N.J.B. Conditions.

Applications to Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493 by 26 Feb., 1955.

APPOINTMENT OF ENGINEERING DRAUGHTSMAN, (BUILDING AND CIVIL ENGINEERING), SUB-AREA ENGINEER'S DEPARTMENT, OLDHAM

Applicants should have had a good general and technical education to at least O.N.C. standard in Building and Civil Engineering, and have had experience in general building construction, design and layout of industrial type buildings, including site works and services.

Salary within range: £510 x £20—£630 per annum according to qualifications and experience. Schedule D, Grade 6. N.J.B. Conditions.

Applications to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 26 Feb., 1955.

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER, WHITEHAVEN DISTRICT

Applicants should have had experience in planning and estimating of schemes and operation and maintenance of both overhead and underground networks at voltages up to and including 33 kV. Applicants should preferably hold the H.N.C. (or equivalent) in Electrical Engineering. Practical experience of overhead line construction is desirable.

The successful applicant will be expected to undertake standby duties.

Salary scales: £755 x £15—£800 per annum. Grade F.7. N.J.B. Conditions.

APPOINTMENT OF SENIOR SALES REPRESENTATIVE, PENRITH DISTRICT

Duties will include the development of sales of electricity and electrical equipment, particularly for Horticultural and Agricultural applications. A good knowledge of equipment and installation methods is

continued in next column

continued from previous column

desirable.

Salary scale: £525/£585 per annum. Grade 2. N.J.C. Conditions.

Applications for above appointments to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 26 Feb., 1955.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (PLANNING), SUB-AREA ENGINEER'S DEPARTMENT, HAZEL GROVE

Applicants should have had experience in protective gear application, system calculations, preparation of specifications and general technical investigations. Preference given to applicants who hold the H.N.C. (or equivalent) in Electrical Engineering.

Salary scale: £715 x £15—£760 per annum. Grade H.10. N.J.B. Conditions.

APPOINTMENT OF THIRD ASSISTANT ENGINEER, (OPERATION AND MAINTENANCE), SUB-AREA ENGINEER'S DEPARTMENT, HAZEL GROVE

Applicants should have a sound knowledge of the operation and maintenance of substations and overhead and underground feeders, at voltages up to and including 33 kV, associated with an industrial and rural distribution system.

Graduate membership of the Institution of Electrical Engineers or exempting qualifications will be an advantage.

Salary scale: £715 x £15—£760 per annum. Grade H.10. N.J.B. Conditions.

APPOINTMENT OF SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER, (SERVICE ENGINEER), STOCKPORT

Applicants should have had experience in the control and supervision of industrial and domestic contract wiring, including preparation of specifications and the installation, repair and maintenance of appliances on consumers' premises.

Salary scale: £755 x £15—£800 per annum, Grade F.7. N.J.B. Conditions.

APPOINTMENT OF ENGINEERING DRAUGHTSMAN (BUILDING), SUB-AREA ENGINEER'S DEPARTMENT, HAZEL GROVE

Applicants should have experience in the preparation of working drawings for the construction of electricity substations, service centres and offices, etc. Some knowledge of quantities and the preparation of specifications will be considered an advantage.

Salary within range: £510 x £20—£630 per annum according to qualifications and experience, Schedule D, Grade 6, N.J.B. Conditions.

APPOINTMENT OF SENIOR DEMONSTRATOR (FEMALE), SUB-AREA CONSUMERS' ENGINEERS' DEPARTMENT, HAZEL GROVE

Applicants should be experienced in the demonstration of cooking by electricity and hold a recognised certificate in cooking or institutional management.

The duties will include recruitment and training of staff, co-ordination of work of District Demonstrators, liaison with educational authorities and women's organisations.

Salary scale: £585/£645 per annum, Grade 3, N.J.C. Conditions.

Application forms for the above appointments can be obtained from the Sub-Area Manager, No. 7 Sub-Area, The North Western Electricity Board, Chapel St, Hazel Grove, Cheshire, and must be returned to him by 26 Feb., 1955. (P 781)

THE SOUTH WALES ELECTRICITY BOARD

REQUIRED SENIOR ASSISTANT (Industrial Supply), Commercial Department, Central Sub-Area of the Board at Cardiff.

Duties involved include the negotiation of important supplies to industry, general development of the industrial load and advice to industrial consumers upon utilisation of electricity.

Salary—Class K, Grade 4 (£1,195/£1,300) of N.J.B. Schedule.

Applications stating age, present position and salary, qualifications, experience and three referees, to be addressed to the Secretary to arrive by 26 Feb., 1955.

D. G. DODDS,
Secretary.

St. Mellons,
Cardiff. (P 810)

EASTERN ELECTRICITY BOARD
Essex Sub-Area Headquarters, Brentwood
ENGINEERING DRAUGHTSMAN

CANDIDATES should have had a good technical training and experience in the design and construction of substation buildings, layout of equipment, the preparation of electrical diagrams, 33 kV records and associated work. A sound knowledge of building construction is essential.

Salary in accordance with Grade 6, Schedule D, of the National Joint Board Agreement within a range of £510/£630 plus London Allowance. Future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, by letter, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the Manager, Eastern Electricity Board, "Millfield," Bentley, Nr. Brentwood, Essex, within 14 days of the appearance of this advertisement. (P 809)

THE NORTH EASTERN ELECTRICITY BOARD
Harrogate Sub-Area

APPLICATIONS are invited for the appointment of GENERAL ASSISTANT ENGINEER, Harrogate.

Duties will be mainly survey for overhead lines, cables and substations and preparation of technical details.

Salary—Schedule A, Class G, Grade 13, £555/£600 per annum, N.J.B. conditions of service.

Applications stating age, qualifications and experience should be forwarded to The Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (P 797)

SOUTH WESTERN ELECTRICITY BOARD
ENGINEERING DRAUGHTSMAN—TORBAY DISTRICT

SALARY N.J.B. Schedule D.6—£510/£630 per annum.

Duties include preparation of engineering drawings for overhead lines and substations, route plans, wayleave plans, and distribution network extensions. Previous experience of these duties essential and possession of H.N.C. an advantage.

Application forms obtainable from Manager, Torbay District, Electric House, Union St, Torquay, to be returned by 1 Mar., 1955. (P 838)

A SPECIAL REPRESENTATIVE with a thorough knowledge of Electrical Accessories and Cables is required for the London and Home Counties Area by Volex Electrical Products Ltd., Salford 6. He must have an established connection with Architects, Contractors, Electrical Authorities and Wholesalers. Salary, commission, expenses and car provided. Pension scheme in operation. Applications in confidence to Mr H. Finch, Sales Promotion Director. (P 729)

ASSISTANT with technical qualifications required by Metropolitan-Vickers Electrical Company Limited, Trafford Park, Manchester 17, to train as Industrial Information Officer; experience of this type of work is not essential. Salary will depend on qualifications and experience and will be progressive. Write, giving full particulars, including age, sex, nationality, education and experience, to the Personnel Manager, marking envelope "H2." (P 751)

ABSTRACTOR required for Engineering and Physics subjects by Metropolitan-Vickers Electrical Company Limited, Trafford Park, Manchester 17. Progressive opportunities for one who has ability for concise expression; is interested in new developments and in writing up technical matter. Engineering experience would be an advantage initially, but experience in abstracting not essential. Apply in writing, to the Personnel Manager, giving details of technical qualifications, experience, if any, and present salary. Mark envelope "F1." (P 750)

ASSISTANT SWITCHGEAR SALES ESTIMATING ENGINEER (Inside) required for London Office of George Ellison Ltd., 131 Victoria St. S.W.1. Works experience and some knowledge of office routine essential. Salary according to qualifications, age and experience.—Write to Branch Manager giving details of technical training and experience. (P 816)

BRITISH ELECTRICITY AUTHORITY require PRINCIPAL ASSISTANT in the Education and Training Branch at Headquarters in London. The person appointed will be concerned in making known opportunities for careers in the electricity supply industry. Duties will involve travelling and will include preparation of publicity material; making contact with professional societies, universities, colleges and schools, employment bureaux, the Youth Employment Service and other organisations; giving careers talks and interviewing. Candidates must have had a sound education and training in engineering, and be familiar with the educational system in England and Wales. Knowledge of the electricity supply industry is desirable. Salary N.J.C. Grade 9 (£1,120/£1,240) inclusive. Superannuation Scheme. Applications to D. Moffat, Director of Establishments, British Electricity Authority, Winsley St, London, W.1, by 28 Feb., 1955. Quote Ref. 569 A.E. (P 775)

BRUCE PEEBLES AND CO., LTD., Engineers, Edinburgh 5, have vacancies in their Transformer Department for the following appointments: SENIOR TRANSFORMER DRAUGHTSMEN capable of personally undertaking the electrical and mechanical layout of transformers up to 30 MVA at 132 kV. Good opportunities to broaden experience by working on layout of larger and higher voltage units. CONTROL GEAR DRAUGHTSMEN with experience in electrical and mechanical layout of switchgear and/or transformer control panels. Salaries commensurate with experience and qualifications; permanent appointments, with Pension and Production Bonus Schemes; five-day week; assistance in obtaining house accommodation. Applications to Mr R. W. Flux, Manager, Transformer Department at above address. (P 746)

BRITISH INSULATED CALLENDER'S CABLES LTD., have a vacancy with their Telecommunications Laboratory at Kirkby for an HONOURS GRADUATE in Physics or Electrical Engineering to take charge of a small but growing team engaged in the design of accessories for audio, carrier and V.H.F. cables and the development of pneumatic protection for underground cables. Applications quoting reference P/58/54 should be submitted to: The Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. (P 820)

BOILER HOUSE MANAGER required by a large and modern industrial company. Applicants should possess a thorough knowledge of, and experience in, the operation and maintenance of high pressure automatic stoker fired water tube boilers and their auxiliaries. An attractive commencing salary will be offered. To the right man, this is a permanent, progressive and pensionable appointment.

Replies will be treatde in strict confidence. Please send brief particulars of age, experience, etc., to—Box No. 4273, Electrical Times. (P 832)

CABLE ESTIMATOR required for permanent, progressive position with established manufacturing company abroad. Minimum 10 years' experience in detailed estimating and pricing of electric power cable and dry core telephone cable essential. Single man preferred. Pension and other amenities available. Passage paid for successful candidate.—Box No. 4257, Electrical Times. (P 720)

DRAUGHTSMAN with some experience of electrical and light engineering required for a small works in London, S.W.1. Interesting job; good opportunity for enterprising man. State age, experience and salary required.—Box No. 4275, Electrical Times. (P 833)

DEPUTY CHIEF SWITCHGEAR ENGINEER

Applications are invited for the position of Deputy Chief Switchgear Engineer with South Wales Switchgear Ltd., Blackwood, Monmouthshire. The successful applicant will be required to direct, under the Chief Engineer, the design, development and testing of medium voltage and high voltage circuit breakers and associated equipment. Applicants should hold a degree in Engineering or equivalent qualifications. Salary will be commensuiate with the responsibilities involved. Applications which will be treated in strict confidence should give particulars of education, training, experience and age, and should be addressed to the

Managing Director,
South Wales Switchgear Ltd.,
Blackwood, Monmouthshire.

(P 776p)

DESIGN DRAUGHTSMAN required by Company in North London Area to work under direction of qualified engineer on design and development of electromechanical products for the electrical, aircraft and automobile industries. Knowledge of mass production methods, tooling and manufacturing tolerances is essential and some electrical knowledge is desirable. He will be responsible for the maintenance and organisation of drawing office records. Full details of experience required.—Box No. 4255, Electrical Times. (P 708)

DEVELOPMENT AND DESIGN ENGINEER (Assistant) with experience on discharge lamp chokes and transformers or allied radio products required by firm of Electrical Engineers in the North of England. A knowledge of the problems involved in quantity production of these items would be an advantage.

Excellent opportunity for suitable man. Superannuated Staff position. Please apply giving details of age, experience, qualifications and salary expected to—Box No. 4265, Electrical Times. (P 821)

DRAUGHTSMAN with experience in electrical control diagrams and wiring layouts for travelling cranes and hoists. The position is permanent and progressive. Pension scheme, excellent staff canteen facilities, 5-day week. Apply in writing, stating age, experience and salary required to: The Personnel Manager, The Vaughan Crane Company Limited, West Gorton, Manchester 12. (P 817)

DRAUGHTSMEN, senior and junior, for permanent pensionable positions at Bellshill or Blantyre, Lanarkshire; for design of switchgear and motor control gear; preferably with electrical or sheet metal experience, or knowledge of mechanisms or flameproof requirements. Salary at or above AESD rates in accordance with experience and ability. Five-day week. Apply in writing to Mr Thomson, The Belmos Company Ltd., Bellshill, Lanarkshire. (P 778)

DRAUGHTSMAN, aged 20/30, preferably with Higher National Certificate in Mechanical and Electrical Engineering required for interesting work on development of Overhead Transmission Line equipment and busbar installations. Pension Fund. 5-day week. Staff Canteen. Apply in writing, stating qualifications, experience, salary required and quoting reference L/78/55, to Staff Officer, British Insulated Callender's Cables Limited, 21 Bloomsbury St, London, W.C.1. (P 792)

ELECTRICAL DRAUGHTSMAN required, Higher National Certificate standard, knowledge of electronics an advantage. Pension scheme. Apply in writing to the Chief Engineer, The Bowater Paper Corporation Limited, Northfleet, Kent. (P 777)

THE DE HAVILLAND ENGINE COMPANY LIMITED

Leavesden Aerodrome,

Near Watford, Herts.

Invite applications for the position of ASSISTANT TO PLANT ELECTRICAL ENGINEER. Will be required to cover preparation and, during erection, supervision of:

Factory H.T. and L.T. Systems.

Motor Applications and Lighting Schemes.

Applicants should be capable of preparing Circuit diagrams and installation drawings for ground equipment associated with the development section of the Company's projects.

Applications, if in writing, to give age, qualifications and details of previous experience to, The Personnel Officer at the above address. (P 779p)

ESTIMATORS for Indoor Sales Staff required by Crompton Parkinson Ltd., Chelmsford. Applicants must have initiative and be experienced in dealing with enquiries relating to A.C. and D.C. rotating electrical machinery up to 1,500 h.p./kW. Superannuation scheme, and extensive social, sports and welfare facilities. Write giving fullest particulars to the Personnel Officer. (P 721)

ELECTRICAL DEVELOPMENT ENGINEER required by leading suppliers of electric welding equipment. Men of Higher National Certificate standard who have served apprenticeship and with some experience of welding requirements preferred. Interesting work and good prospects. Please apply at once to Dept. W.E.D., The Quasi-Arc Company Limited, Bilston, Staffs, giving full particulars of age, qualifications and experience. (P 814)

EXPERIENCED ENGINEERS required for the erection of lattice tower and wood pole Overhead Transmission Lines and willing to serve either at home or overseas. Applicants should have a technical background up to Higher National Certificate (Electrical) standard. Pension Fund. Apply in writing stating age, experience, qualifications, salary required and quoting reference C/77/55 to Staff Officer, British Insulated Callender's Construction Company Limited, 30 Leicester Square, London, W.C.2. (P 793)

ELECTRICIAN-MECHANIC required by Mining Company in Nigeria, fully competent to erect and maintain new electrical installation. Tours eighteen months with intervening paid leave, free passages, and cost of living allowance. Applications giving age, qualifications, experience and salary required to Box 529, Walter Skinner Ltd., 20 Copthall Ave, London, E.C.2. (P 789)

INFORMATION OFFICER required to assist in technical information for research engineering and commercial departments of a large electrical engineering firm in the North West. Qualifications in engineering are essential. Experience in industrial information work and knowledge of French or German would be advantageous. Salary will depend on qualifications and experience. Advancement will be rapid for the right type of applicant. Reply, giving particulars of training and experience to—Box No. 4263, Electrical Times. Mark envelope "Information." (P 752)

JUNIOR TECHNICAL ASSISTANT (20-25) for the preparation of lighting schemes, Illuminating Engineering Dept., old established manufacturers lighting equipment. State age, experience, salary required. Chief Engineer, Technical Service Dept., Holophane Ltd., Elverton St, Westminster, S.W.1. (P 764)

ILLUMINATING ENGINEER required to assist in preparation of interior lighting schemes in London area. Write stating age and experience to—Box No. 4267, Electrical Times. (P 822)

JOHNSON AND PHILLIPS LIMITED require a senior DRAUGHTSMAN in their Switchgear Department. Applicants must be suitably qualified and competent to handle switchgear substation and power station designs up to 33,000 V and designs embracing Air and Oil Circuit Breakers. This is an attractive post with the possibility of reaching a key position and carries generous pension and benevolent facilities. Applications stating age, training and experience to Employment Manager, Messrs Johnson and Phillips Limited, Victoria Way, Charlton, S.E.7. (P 770)

JUNIOR DRAUGHTSMAN required for design and development of new small electric tools and other equipment. Write Managing Director, Martindale Electric Co., Ltd., Westmorland Rd, London, N.W.9. (P 796)

LAND SURVEYORS required to carry out detailed instrument survey on overhead power line routes in Scotland. Apply to James Kilpatrick and Son Limited, Kelvin House, River Cart Walk, Paisley. (P 815)

LIGHTING SALES ENGINEER with ability to discuss modern lighting technique with Architects and users. Write stating age and experience to—Box No. 4269, Electrical Times. (P 823)

LONDON Consulting Engineer requires ELECTRICAL ENGINEER for design of installation work in factories, schools, office buildings, etc. Previous experience in Consultants or similar establishment an advantage. Superannuation Scheme. Write stating age, experience, qualifications and salary required to G. H. Buckle and Partners, 2 Harrington Gardens, London, S.W.7. (P 748)

LONDON export department of switchgear control gear manufacturers require SALES ENGINEER to deal with estimates, tenders, overseas correspondence; interesting and progressive position write—Box No. 4229, Electrical Times. (P 654)

METER TESTER required by London Electricity Board in Central Testing Station of South Eastern Sub-Area at Erith, Kent. N.J.I.C. rates and conditions—4s. 5d. per hour. Application forms from Personnel Officer, 46/7 New Broad St, E.C.2. Please enclose addressed envelope and quote ref.: M/3767/T. (P 772)

METROPOLITAN-VICKERS ELECTRICAL COMPANY LIMITED, Trafford Park, Manchester 17, have vacancies in the Research Department for TECHNICAL ASSISTANTS for development work on electrical INSULATING MATERIALS and VARNISHES. Applicants should not be over age 27 and should have technical knowledge or experience of electrical engineering. Apply to the Personnel Manager, marking envelope "W." (P 652)

POWER TRANSFORMER DRAUGHTSMAN required having thorough knowledge of units up to 20 MVA. Full particulars giving age, experience and salary required to—Box No. 4251, Electrical Times. (P 704)

PRODUCTION PLANNING ENGINEER required for factory in Enfield. Should have had experience preferably but not essentially in electronic valve production. Must be able to break down programmes into component part requirements and raw materials, and organise supplies. Also must be able to assess plant capacities and organise loading in economic quantities. Knowledge of ratefixing and incentive schemes essential. Salary £900/£1,000 per annum. Apply Personnel Superintendent, The Edison Swan Electric Co., Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. (P 787)

Appointments are available

with

THE ENGLISH ELECTRIC COMPANY LIMITED

on important work covering Application Engineering on all classes of electrical equipment. These appointments are pensionable after a qualifying period and apprentice trained men with Higher National Certificate in Electrical or Mechanical Engineering or equivalent and with previous experience on Application work are preferred.

Experience in the manufacturing or power supply industries or in the application or installation of electrical equipment in any branch of industry or engineering is an alternative qualification and professional engineers in these fields are also invited to apply.

A number of vacancies also exist for apprentice trained engineers seeking an opportunity of acquiring experience in the application of electrical equipment.

Reply stating age, experience and qualifications to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 950. (P 782p)

POWER STATION CONTROL ENGINEER on attractive shift rota required for modern Chemical Works. Candidates should possess technical qualifications, preferably to Higher National Certificate Standard, Ordinary National Certificate standard will be considered with experience of A.C. Turbine Generation and a good knowledge of protective gear; transformers, HT and LT Switchgear and the normal Power Station and Substation equipment. Salary to commence including shift allowance £625 per annum rising to £700 per annum including shift allowance with possibilities for further advancement. Contributory Staff Pension Scheme. Sickness and Accident Benefit Scheme. Applications in writing to the Personnel Manager, Petrochemicals Ltd., Partington Industrial Estate, Urmston, Manchester, quoting reference No. Eng/32. (P 831)

SALES ENGINEERS, automatic control gear and switch fuse gear, required operating in the Lancashire, Yorkshire, and Birmingham areas. Must have confidence in own ability and capacity for hard and sustained work. Outside sales experience essential. Salary commensurate with qualifications and experience. Apply in writing only to the Sales Manager, The Donovan Electrical Co., Ltd., Granville St, Birmingham. (P 687)

SKILLED ELECTRICIANS required for maintenance of large motors, starters, automatic contactor gear and distribution switchgear in large paper mills in North Kent. Must be experienced in fault finding and able to read drawings and wiring diagrams. Permanent employment for the right men. Pension scheme, canteen facilities and sports club. Apply stating age, training and experience, to—Box No. 4247, Electrical Times. (P 695)

SERVICING ATTENDANTS and ASSISTANT SERVICING ATTENDANTS required for Railway Electric Traction Substations. Shift work involved. Standard rate of pay 165s. 8d. and 153s. 8d. respectively for week of 44 hours, plus allowances. Pensionable employment. Certain free and reduced rate rail travel after qualifying period. Good prospects for promotion. Apply Substation and Track Inspector, Chadwell Heath Control Station, British Railways, Chadwell Heath, Essex (Tel. Seven Kings 9613) or nearest Employment Exchange. (P 819)

THE ENGLISH ELECTRIC CO., LTD.

have vacancies at Stafford for the following Mechanical Engineers to be engaged upon important development work associated with Rotating Electrical Machines.

(*a*) SENIOR ENGINEERS with a University Degree, having specialised either in Thermo-dynamics or Strength of Materials and with post-graduate industrial experience in either field.

(*b*) ENGINEERS with H.N.C. in either of the above subjects, together with appropriate industrial experience, who would be required to act as assistants to the Senior Engineers.

The posts are permanent, progressive and pensionable, the salary being commensurate with experience. Reply with full details of qualifications and experience to:

Dept. C.P.S., 336/7, Strand, W.C.2, quoting Ref. 1379.

(P 818p)

TECHNICAL ASSISTANT is required for the Agricultural Department of The General Electric Co., Ltd., at their Head Office, for work concerned with crop drying which requires a knowledge of heating and ventilation. Applicants should not be more than 35 years of age and preferably have obtained the O.N.C. in Electrical Engineering. This is an interesting position and offers opportunities for advancement. Apply in writing, quoting Ref. A.G. to the Staff Manager, The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. (P 766)

TECHNICAL ASSISTANT to Works Manager with practical experience in the design, manufacture and testing of Rubber and Thermoplastic Cables. Capable of supervising technical processes and inspection. Knowledge of materials and compounds, including recent developments in Thermoplastics, essential.

The appointment is pensionable and the salary commensurate with qualifications and experience.

Applications in writing, stating age, experience and positions held, to The Secretary, Mersey Cable Works Limited, Linacre Lane, Bootle, Liverpool 20. (P 773)

TELECOMMUNICATIONS (LINE TRANSMISSION) ENGINEER required by large organisation in the North West to train for position in Technical Publicity Department.

Applicants should be aged 25-30 years, and should have a good education background with the ability to write clear concise English. A sound knowledge of modern telecommunications techniques, including coaxial and other multi-channel carrier telephone and telegraph systems, essential.

The position is on the established staff of the Company, with contributory Pension Fund, and usual staff conditions and amenities. Please write to Box No. 438, Dorland Advertising Ltd., 18/20 Regent St, London, S.W.1, giving details of age, qualifications and experience. (P 712)

TECHNICAL REPRESENTATIVE required by a West Middlesex Electrical Engineering Firm engaged in the repair of all type of A.C. and D.C. equipment. This position carries excellent prospects to man with initiative and ability to build up this go-ahead firm. Good wages and commission. Car provided. Apply in first instance to—Box No. 4277, Electrical Times. (P 834)

TRANSFORMER DESIGN ENGINEER required to take charge of small design office. Applicant should be fully conversant with and have considerable experience in the design and manufacture of Power transformers up to 66 kV. Situation West London. The position is progressive, pension scheme available. Applicants should state age, experience, qualifications and salary required.—Box No. 4181, Electrical Times. (P 826)

TELECOMMUNICATIONS (RADIO TRANSMISSION) ENGINEER required by large organisation in the North West to train for position in Technical Publicity Department.

Applicants should be aged 25-30 years, and should have a good general educational background with the ability to write clear concise English. A sound knowledge of modern telecommunications techniques, including V.H.F. and U.H.F. multi-channel systems and frequency-shift signalling practices, essential.

The position is on the established staff of the Company, with contributory Pension Fund, and usual staff conditions and amenities. Please write to Box No. 434, Dorland Advertising Ltd., 18/20 Regent St, London, S.W.1, giving details of age, qualifications and experience. (P 711)

TRANSFORMER DRAUGHTSMAN required, fully experienced in all types up to 2,500 kVA. Full particulars giving age, experience and salary required to the Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. (P 698)

WHIPP AND BOURNE LTD. require DRAUGHTSMEN with experience of medium or high voltage switchgear. Apply with full details to Switchgear Works, Castleton, Rochdale, Lancs. (P 734)

WORKS OR MAINTENANCE ENGINEERS required for factory in Sunderland. Must have had experience in installation and operation of factory services, including heating, ventilation, water, gas and electricity supply; maintenance of machine tools and appliances used for light mass production work, and drawing office experience in mechanical design. Ability to control office and works staff is necessary. Salary £750/£900 per annum. Apply Personnel Superintendent, The Edison Swan Electric Co., Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. (P 786)

APPOINTMENTS WANTED

QUALIFIED ELECTRICAL ENGINEER requires part-time work, drawing, surveys, specifications, etc. Anything considered.—Box No. 4271, Electrical Times. (P 827)

SITUATION required in FRANCE by ex ARMY TECHNICAL OFFICER, age 37, Proprietor of Electrical Contracting, Radio and Television business. Extensive knowledge of Electrical Contracting and Electronics, also business side of above. Serious illness of French wife reason for change.—Box No. 4249, Electrical Times. (P 697)

PATENTS

BRITISH Patent No. 656,486. Installation for wireless calling in circuits comprising combined transmitting and receiving stations. British Patent No. 660,579. Improvements in or relating to devices for phase modulation of electric oscillations. British Patent No. 660,645. Improvements in or relating to devices for phase modulation of electric oscillations. The proprietors of the above Patents are desirous of entering into an arrangement by way of a Licence or otherwise on reasonable terms for the purpose of exploiting the above Patents and ensuring their practical working in Great Britain.

All enquiries to be addressed to Heron Rogers and Company, Bridge House, 181 Queen Victoria St, London, E.C.4. (P 769)

BUSINESS OPPORTUNITIES

MAIL ORDER FIRM welcomes enquiries from manufacturers of Competitive Electrical appliances for inclusion in Current Catalogue. Write—Box No. 4279, Electrical Times. (P 835)

ELECTRICAL MANUFACTURING ENGINEERS welcome contract enquiries for light assembly work. Capacity for cellulose spraying and metal polishing. Write in confidence.—Box No. 4281, Electrical Times. (P 836)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (P 4)

ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum cleaner and drill armatures replaced from stock 24-hour service. Every job guaranteed. All vacuum cleaner parts, hoses, etc., in stock for any make. Apex washer agitator shafts stocked.—Regam Electric Cleaner Service 95 Park Lane, Leeds 1. (P 5)

FISHER FOUNDRIES LTD., Greet, Birmingham 11, for Machine Moulded Precision Castings in gun metal and soft grey iron. Tel.: Victoria 0197. (P 6)

LET US SOLVE YOUR BREAKDOWN PROBLEMS, repairs speedily carried out by experts. Collection and Delivery by our own transport. A. T. Robinson, Electrical Power Engineers, The Green, Southall, Middx. Southall 3494/5/6. (P 730)

METALWORK. All types cabinets, chassis, racks, etc., to your own specification. Philpotts Metalworks Ltd., Chapman St, Loughborough. (P 333)

WANTED

SCRAP MERCURY wanted: Top prices. Cash on collection within 50 miles London for reasonable quantities. Also aircraft plugs, contacts (new or used) all grades non-ferrous and precious scrap metals any form. Belgrave Buyers (E.T.), 5 Belgrave Gardens, London, N.W.8. MAI. 7513. (P 829)

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper Ltd. 176 Brady St, Bethnal Green, E.1. (P 1)

WANTED, ROTARY CONVERTERS, any size.—Universal, 221 City Rd, London, E.C.1. (P 3)

FOR SALE

THE EAST SUSSEX COUNTY COUNCIL

invite Tenders for the purchase of ELECTRICITY GENERATING PLANT as under:

Engine by National Gas Engine Co., Ltd., with 50/70 V dynamo by Electric Construction and charging board, ammeters, voltmeter, switchgear, etc. No batteries.

Standby Aster Wembley petrol engine (frost damaged) with 50/70 V dynamo by Siemen Bros.

Particulars and order to view may be obtained from the undersigned and by whom Tenders should be received not later than 20 Apr., 1955.

J. CATCHPOLE,
County Architect.

County Hall,
Lewes.
11 Feb., 1955. (P 824)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi. 5105, 67 Rothschild Rd, W.4. (P 8)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co., Ltd., Honeypot Lane, Stanmore, Middx. Edgware 5566-9. (P 9)

A HIGH VACUUM IMPREGNATION UNIT or single or batch coil impregnation service to R.I.C. specification 214 or individual requirements.—Blickvac, Hamilton Rd Works, Hamilton Rd, S.E.27. Tel. Gypsy Hill 4394. (P 14)

HUNDREDS OF MOTORS IN STOCK

1, 2, and 3-ph. and D.C. all sizes Geared Motors, M.G. Sets and special equipment made up. Rewinds and redesigns all sizes, 12 months' guarantee on all supplies and rewinds. Lists sent on request.

EDWARDS, WYATT & COURT LTD.
Grant Street, London, E.13. Grangewood 3697

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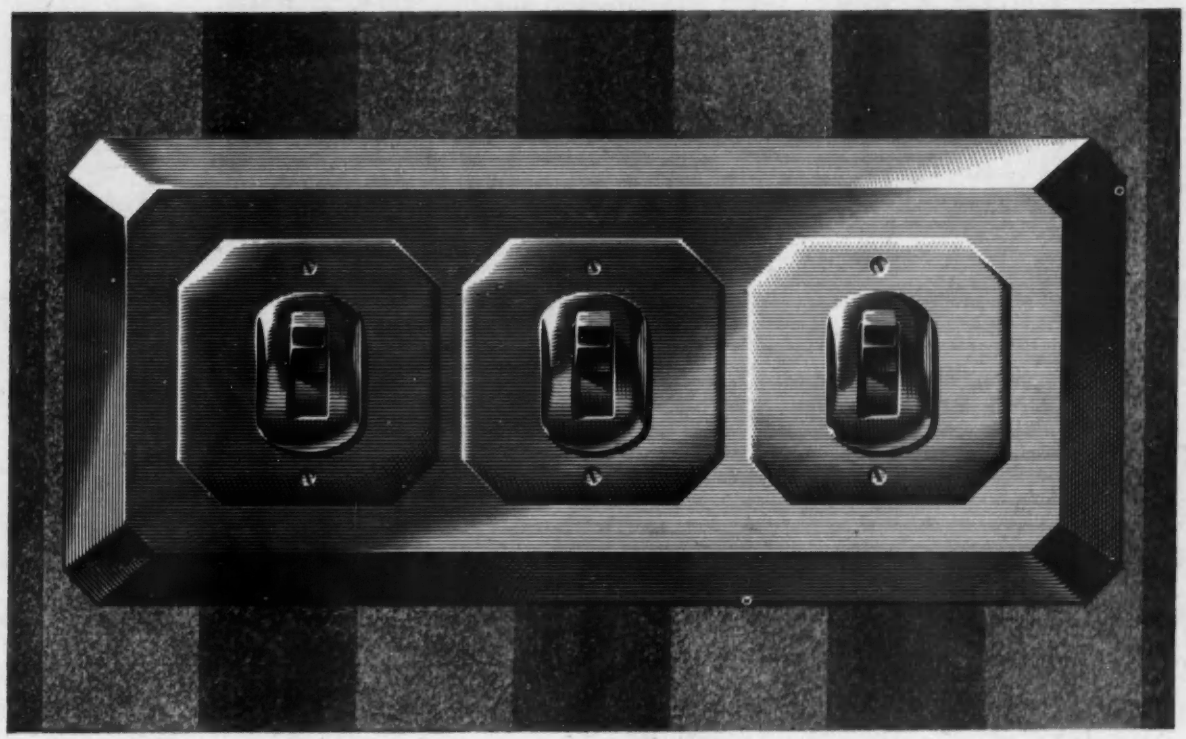

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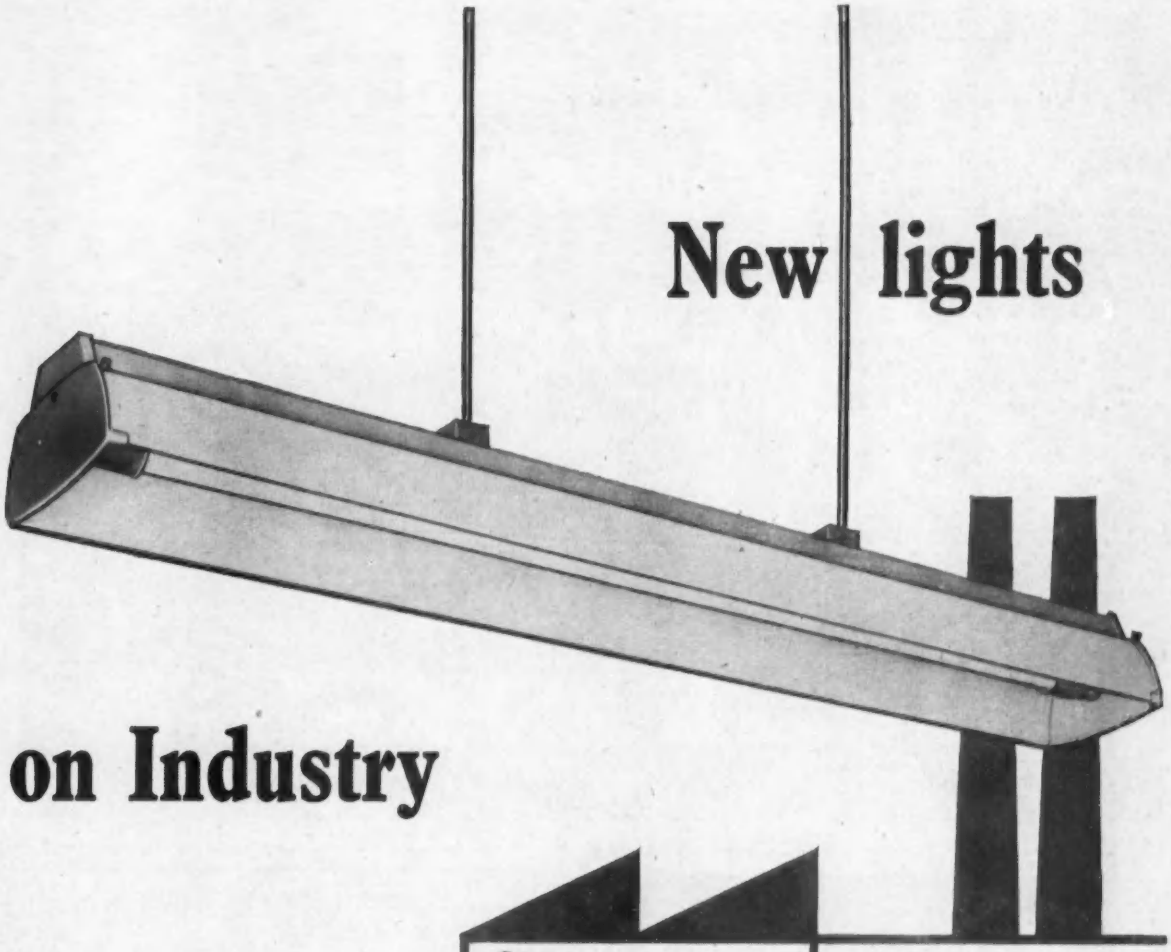

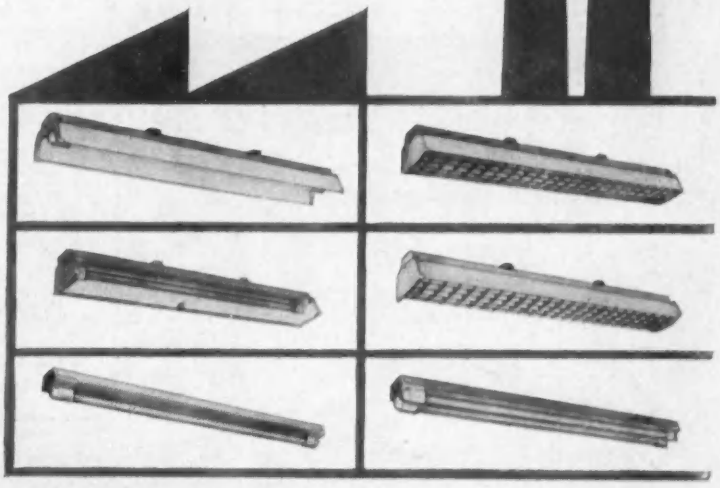

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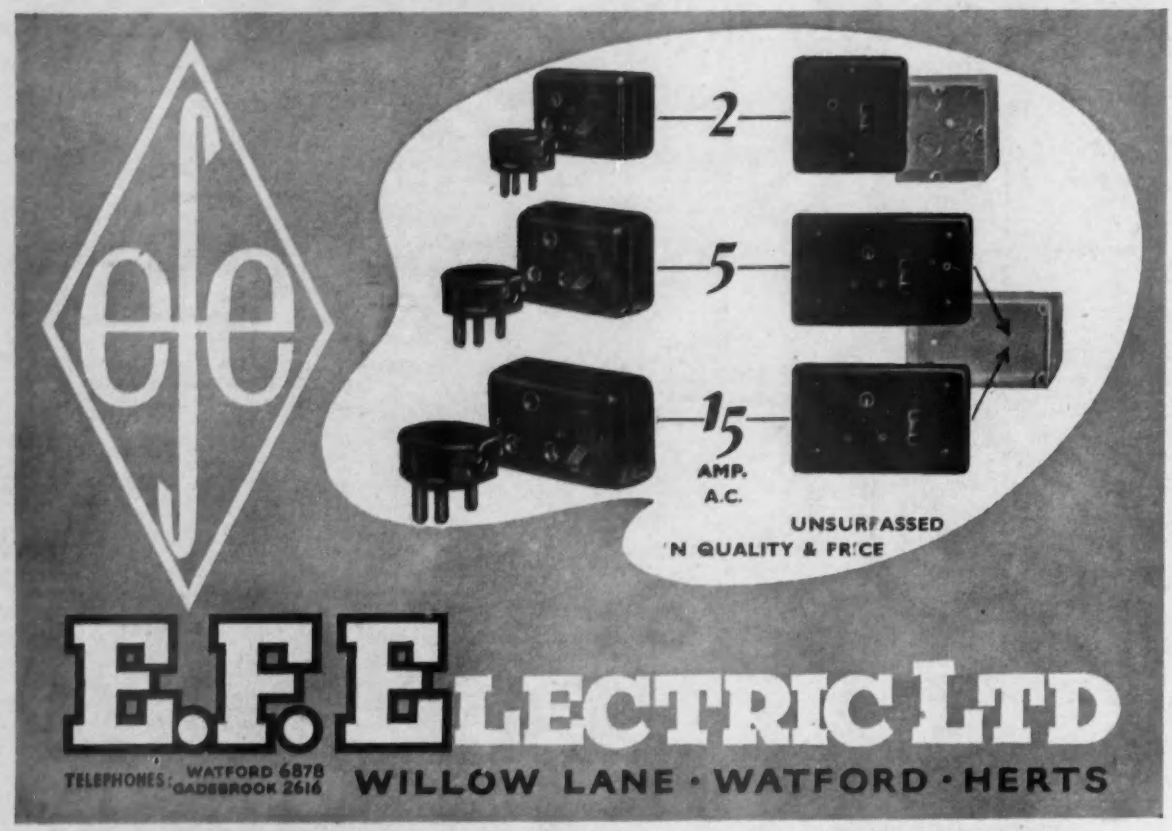

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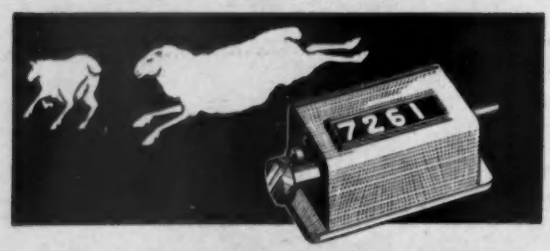

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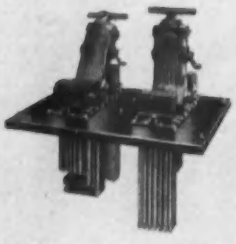

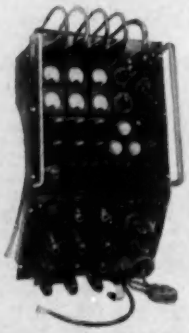

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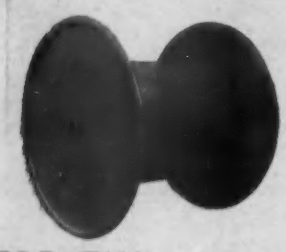

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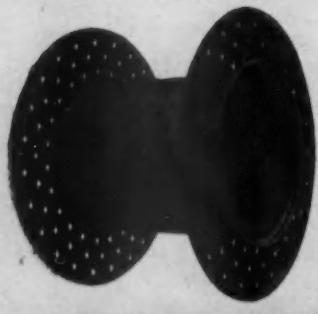

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TARIFF

Electricity will be supplied at this Tariff during the year of account to the Area Board at the points of supply at which electricity was being supplied to the Board by the Central Authority at the commencement of the year of account or at such points as may be agreed between the Central Authority and the Area Board.

The price to be paid for electricity so supplied in the year of account shall be the sum of the charges set out in paragraphs (A) and (B) hereunder:

(A) Fixed Kilowatt Charge

For each kilowatt of simultaneous maximum demand on the Central Authority the sum of £4. 15s. 0d. (four pounds fifteen shillings).

For the purpose of ascertaining the amount of the fixed kilowatt charge twice the largest number of kilowatt-hours supplied by the Central Authority to the Area Board during any half-hour between 7 a.m. and 7 p.m. on any Monday, Tuesday, Wednesday, Thursday or Friday, or between 7 a.m. and 12 noon on any Saturday in the year of account shall be the maximum demand and the "simultaneous maximum demand on the Central Authority" shall be the said maximum demand PROVIDED that if the sum of the said maximum demands of all the Area Boards and the chargeable maximum demands in the year of account of other direct consumers of the Central Authority in England and Wales varies by more than one per cent from 16,630,000 kilowatts the "simultaneous maximum demand on the Central Authority" shall be the said maximum demand multiplied by 16,630,000 and divided by the sum of the said maximum demands of all the Area Boards and the said chargeable maximum demands of other direct consumers.

(B) Running Charge

For each kilowatt-hour supplied by the Central Authority to the Area Board during the year of account the sum of 0·5d. (decimal five of a penny).

Variation of the Running Charge

The running charge shall be increased or reduced by 0·0006d. (decimal nought nought nought six of a penny) for each penny (a halfpenny or any greater part of a penny being treated as a penny) by which the fuel cost per ton in the year of account shall be above or below 60s. (sixty shillings).

For the purpose of this variation:

(a) *Fuel cost per ton* in any period shall be determined as follows:

The total cost of fuel consumed in the period at all the Central Authority's stations in the area of the Area Board taking the supply shall be divided by the total number of tons of fuel so consumed and the cost per ton so obtained shall be multiplied by 11,000 and divided by the average gross thermal value of the fuel so consumed expressed in British Thermal Units per lb.

(b) *"Cost of fuel consumed"* shall mean the sums expended for fuel consumed plus the cost of any transport, handling, preparation or treatment incurred in connection with the delivery of the fuel to boiler hoppers or furnaces and in connection with the disposal of the products or residues of combustion, together with the proper proportion of salaries and wages, and any contributions for pensions, superannuation and insurance of Officers and servants attributable thereto, less any sums received from the sale of any products or residues of combustion.

ERNEST LONG,
Secretary.

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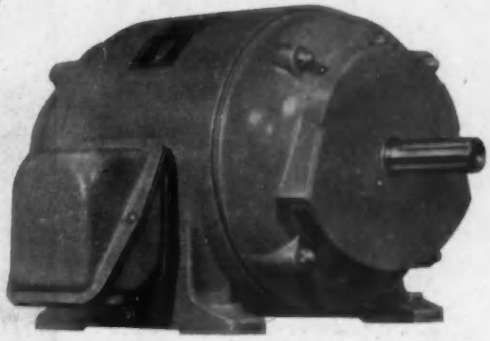

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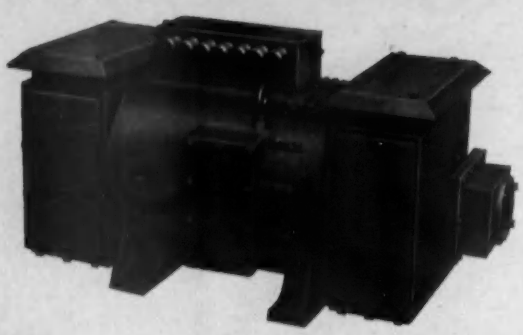

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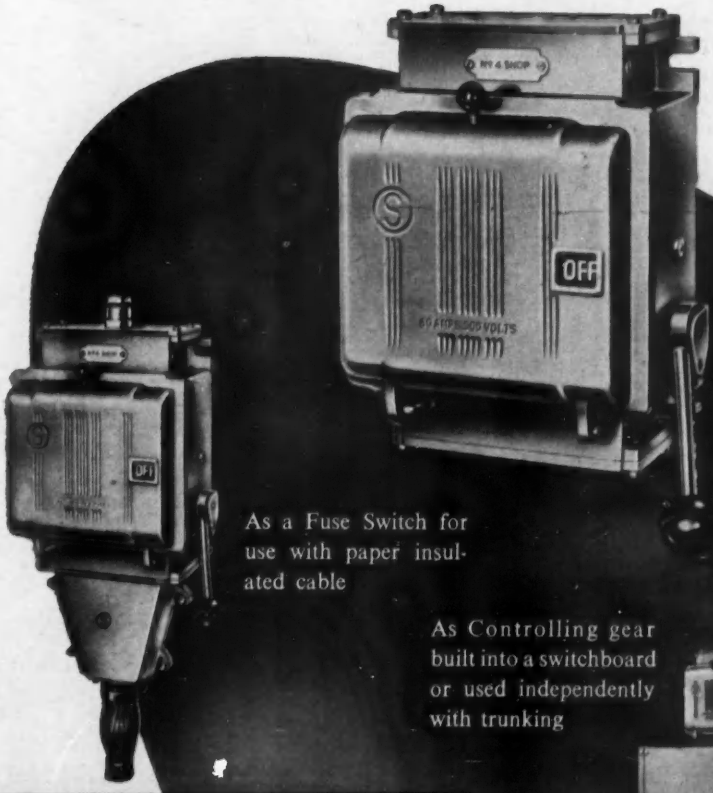

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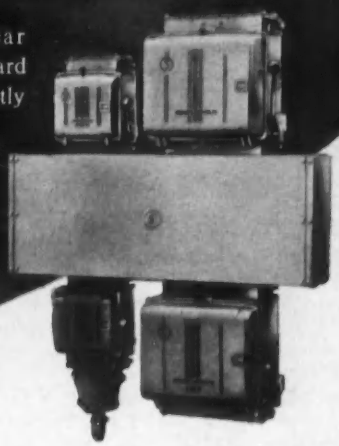

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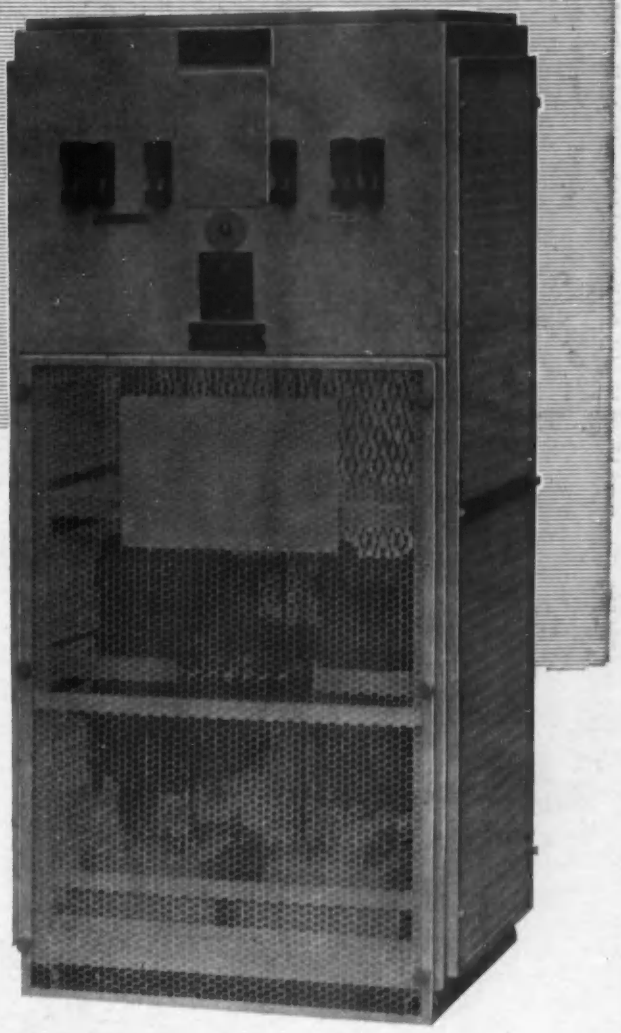

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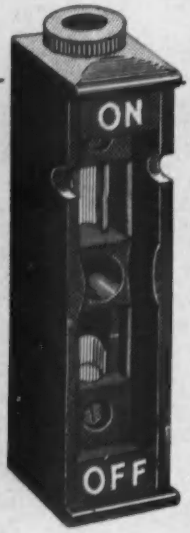

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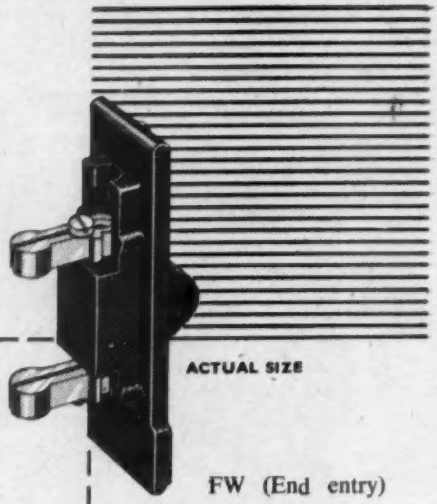

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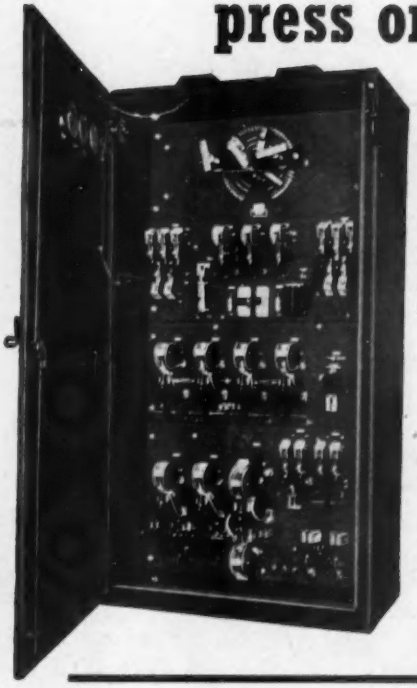

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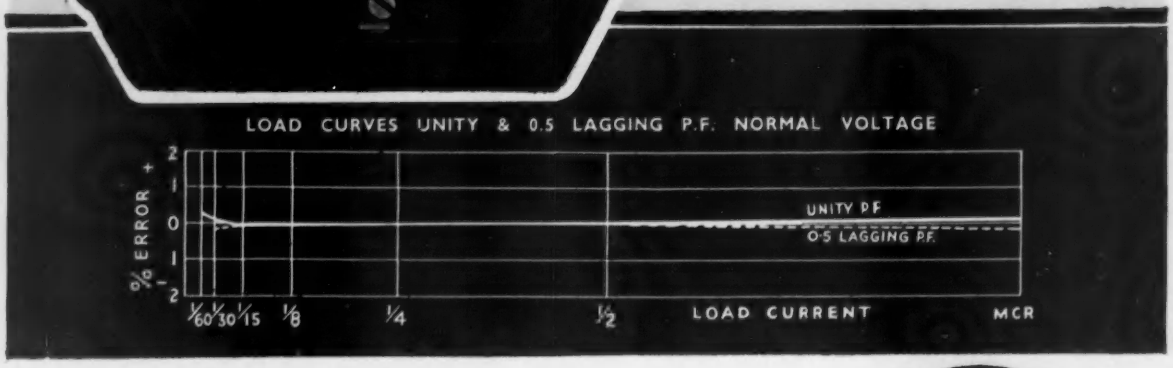

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